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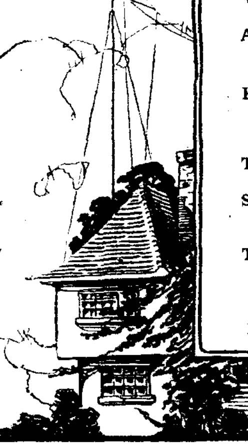

Vol. VI. MODERN WIRELESS. No. 1

Edited by JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.

RADIO PRESS, LTD., BUSH HOUSE, STRAND, LONDON, W.C.2. Telephone: City 9911

Save Four Pounds weight in a 4 valve Portable Set:

"Polar" Coil Unit

The "Polar" Unit is a complete and highly efficient aerial-reaction unit, with micrometric control and facilities for quick reversion of Coils. Completely interchangeable, without need for disturbing setting of Reaction Coil. Coils are available covering wavelengths between 235 and 4,720 metres. Equally suitable for baseboard or panel mounting. Coils for any wavelength occupy the same space. Fits any standard Valveholder. The Unit saves space, trouble and expense.

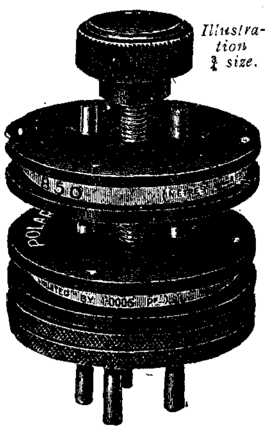

Illustration ½ size.

Coil Unit complete 9/-
Carrier alone ... 3/-
Coils, each ... 3/-

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The "Polar" Resistance-Capacity Coupling Unit, *complete in itself*, gives pure reproduction at all audio frequencies. It embodies non-inductively wire-wound Anode Resistance, a specially-made Dubilier Coupling Condenser and a Gridleak of Mullard type.

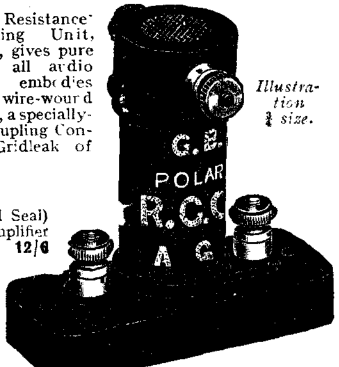


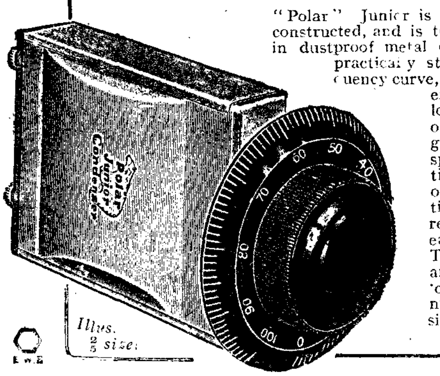
Illustration ½ size.

80,000 ohms (Red Seal) for all stages of Amplifier (except last) 12/6

40,000 ohms (Green Seal) for last stage of Amplifier, 10/6

"Polar" Junior Condenser

"Polar" Junior is very robustly constructed, and is totally enclosed in dustproof metal case. It has a practically straight-line frequency curve, the scale being engraved to allow a movement of 350 degs. This gives wider Dial spacing for Stations tuned in on the lower portion of the scale resulting in easier tuning. Three Capacities are available—·001, .0005, .0003 m.f.d.—all one size and price 6/6



Illus. ⅔ size.

Compare the weight

"Polar" Junior Condenser. 4½ ounces.	Ordinary Vane Condenser. 10 ounces.
"Polar" Resistance-Capacity Coupling Unit. 2 ounces.	L.F. Transformer. 12½ ounces to 1½ lbs.
"Polar" Coil Unit, with 2 Daventry Coils. 2½ ounces.	2-Coil Holder and 2 Daventry Coils. 12 ounces.

-and build your "portable" with Polar Components

IN a 4-Valve Set with Detector and three stages of Low-frequency Amplification, as much as 4 pounds weight can be saved by building with "Polar" Guaranteed Components.

Every important component in the Receiver should bear the Trade-Mark "Polar," because "Polar" Components fill the *essential* needs of a Portable Set.

Those listed here, as the above table shows, keep down the weight to its minimum, and occupy but very small space. And further, "Polar" Components achieve a remarkably high standard of efficiency, putting the *utmost* in results within your reach.

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Radio Communication Co. Ld.

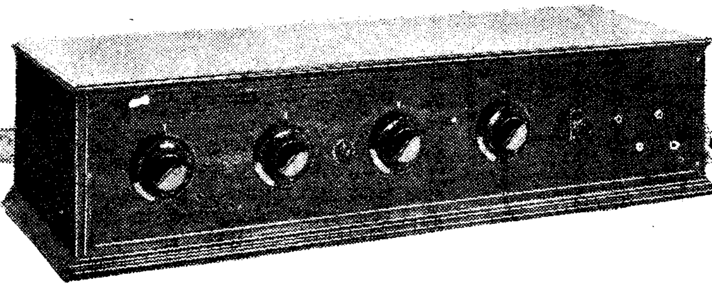
125, Hope Street, GLASGOW. | Barnes, LONDON, S.W.13. | 66, Oxford Street, MANCHESTER.

WIRELESS OPERATORS STILL WANTED. There are now vacancies on our Sea-going Staff for Junior Wireless Operators, trained on our apparatus. Youths of good education, preferably between 17 and 25 years of age, wishing to enter the Wireless Profession, should communicate with the Managing Director, London Radio College, 82–83, High Street, Brentford, Middlesex, who will be pleased to furnish particulars of the training course necessary to qualify for our Service.

The "ELSTREE SIX"

Described by

J. H. REYNER
B. Sc. (Hons.), A.M.I.E.E.



RADIO PRESS LABORATORY'S GREAT ACHIEVEMENT.

NEW ERA OPENS.

SIXTY STATIONS ON THE LOUD-SPEAKER IN ONE HOUR!

Never in the past have I expressed much optimism regarding the range of wireless receivers. My great dissatisfaction with the range and selectivity of modern receivers, both as marketed and as published, has made me a critic very difficult to satisfy in the past. I have expected tuning to be carried out "on the loud-speaker" with utmost ease on distant stations, without in the least straining the last ounce out of the set. I have also felt that all sets were deplorably unselective, and began to wonder whether selectivity plus range could be obtained simultaneously.

The solution of this problem was a matter of months of constant research. I realised that we should have to have laboratories suitably equipped and staffed. The result was "Elstree," and the first problem given to our engineers was to solve that most difficult of all problems in radio history—efficient and properly controlled H.F. amplification. They have solved the problem after months of working on neutralised circuits.

The "Elstree Six" is the set which opens a new era of broadcast reception, and it is not without the closest consideration that I give this opinion. We are prepared to demonstrate the set publicly, and have already done so, *e.g.*, at a lecture at Bradford, the set being 200 yards from the local station! Sixty stations on the loud-speaker in one hour is an extraordinary feat, and this journal is prepared to place this set side by side with any other in this country for a comparative test. We want 500 of our readers from every part of the country to come and hear it for themselves. An entirely new standard is set in selectivity, range and ease of operation and construction. The 1926–27 season will alter the whole complexion of radio reception. Your former home-constructed receiver will be obsolete, and a new interest will be aroused by the publication of "star" sets using various numbers of valves, and which, while not necessarily using the same circuit as the "Elstree Six," will make the fullest use of the circuit and design information which has been amassed by our Elstree Laboratories as a result of months of careful research.

John Scott-Taggart

Editor of MODERN WIRELESS.

SOME months ago the Elstree Laboratories undertook an exhaustive examination of neutralised high-frequency receivers. The methods in use at that time were examined, and their various disadvantages were brought to the surface. It was not very long before the existing methods were abandoned in favour of symmetrical arrangements, and as a result we have had the vogue of split coil circuits.

The Split Coil Method

In this system the tuned circuit is provided with a centre tapping on the coil, and only half the winding is used in the actual circuit, the voltage developed across the other half being utilised to apply the neutralising voltages. The split coil may either be in the grid circuit or the anode circuit of the valve, and various arrangements utilising this principle have been published from time to time.

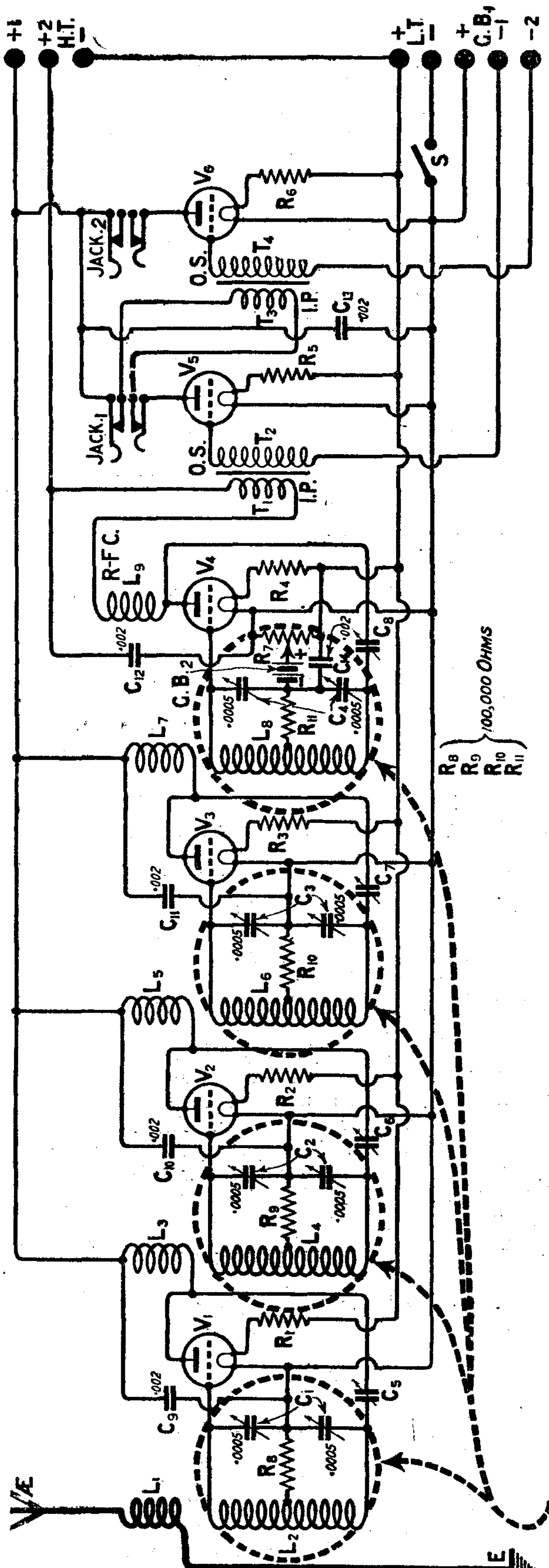


Fig. 1.—The theoretical circuit of the "Elstree Six." The secret of the receiver is revealed in the ringed portions.

Parasitic Oscillations

Experiments on these lines, however, quickly showed that trouble arose due to the generation of parasitic oscillations which were fully discussed in an article in MODERN WIRELESS some months ago. One satisfactory method of overcoming the trouble is to employ a tapped coil alternately with a full coil, so destroying the symmetry as far as the parasitic oscillations are concerned. This method, while satisfactory to some extent, suffers from several disadvantages, chiefly as regards the selectivity obtainable.

Another method of overcoming the difficulty which was developed at the Elstree Laboratories was that incorporated in the "Remarkable Five Valve Receiver" described in the April issue of MODERN WIRELESS. Here the parasitic oscillations were checked by the interposition of small chokes, having only a comparatively small number of turns wound on, in suitable portions of the circuit. This arrangement is satisfactory in practice, but the chokes employed are only suitable for one frequency band, and if the coils are changed to another band, then the choke coils have also to be changed.

The Split Condenser Method

For this reason and others it was decided to try out another method of tackling the difficulty, and what may be called the split condenser method was devised. This method was outlined in a recent issue of *Wireless Weekly* (Vol. 8, No. 8), where it was shown that by taking the centre tapping to the mid point of a dual condenser instead of to the centre point of the coil any tendency to parasitic oscillations was overcome. A circuit employing this principle is shown in Fig. 2. It will be observed that the coil is also centre-tapped, and a high resistance is connected between the centre tapping of the coil and the centre point of the condenser. This resistance which has a value of the order of 50,000 to 100,000 ohms is provided to stabilise the grid of the valve which is otherwise left free. It will be obvious that the two points between which the resistance is connected are at the same high-frequency potential, and therefore the resistance will not introduce any damping into the circuit, but it does provide a direct path between grid and filament through the coil so that the grid is not isolated.

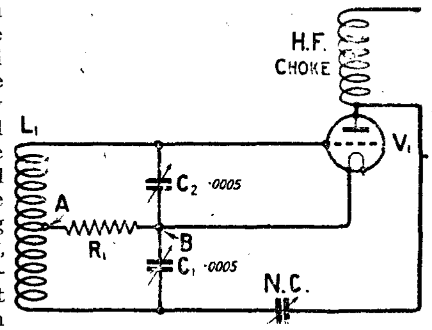


Fig. 2.—This circuit is reproduced from "Wireless Weekly," Vol. 8, No. 8, for purposes of explanation.

Details of the Circuit

This briefly is the principle which has been employed for the six-valve receiver to be described. The receiver employs three stages of high-frequency amplification, a detector, and two stages of low-frequency amplification. The circuit employed is shown in Fig. 1, from which it will be seen that a species of loose-coupled high-frequency transformer coupling is employed for the first three stages. The secondary winding of the transformer is tuned in each case, a dual condenser being used to enable the split condenser principle to be utilised. The primary, which is a simple plug-in coil, is coupled fairly loosely to the tuned secondary. This naturally results in a certain loss of signal strength, which, however, is compensated for by the extra valve. Since the whole system of high frequency amplification is well under control this provides a ready method of obtaining the requisite selectivity.

Anode rectification is used for the detector, which gives an increase both in the selectivity and in the quality. By suitable adjustment of the potentiometer the quality may be adjusted for best results, either with weak or strong signals. The increase in selectivity due to the reduction of the damping imposed by the grid circuit is quite appreciable.

The Components Used

The following components have been used in making up the receiver. Similar components of high quality may be used in the majority of cases. Particular care must be taken, however, to obtain the correct size of dual condenser, which has a capacity of .0005 for each half. This is rather larger than the ordinary dual condenser, but since both halves of the condenser are effectively in series in the tuned circuit, the effective capacity of the condenser is only .00025. Obviously if the capacity of each half of the condenser is smaller, then the total capacity will be too small for satisfactory operation. For this reason the use of the specified condenser is preferable.

You will require:

Four Cyldon .0005 double variable condensers. (Sydney S. Bird.)

One neutralising condenser for panel mounting. (Peto-Scott Co., Ltd.)

Two jacks.

One filament key switch. (Igranic Electric Co., Ltd.)

One potentiometer. (Lissen, Ltd.)

One Marconi Ideal transformer (2.7 to 1). (Marconiphone Co., Ltd.)

One Marconi Ideal transformer (6 to 1). (Marconiphone Co., Ltd.)

One H.F. choke. (Lissen, Ltd.)

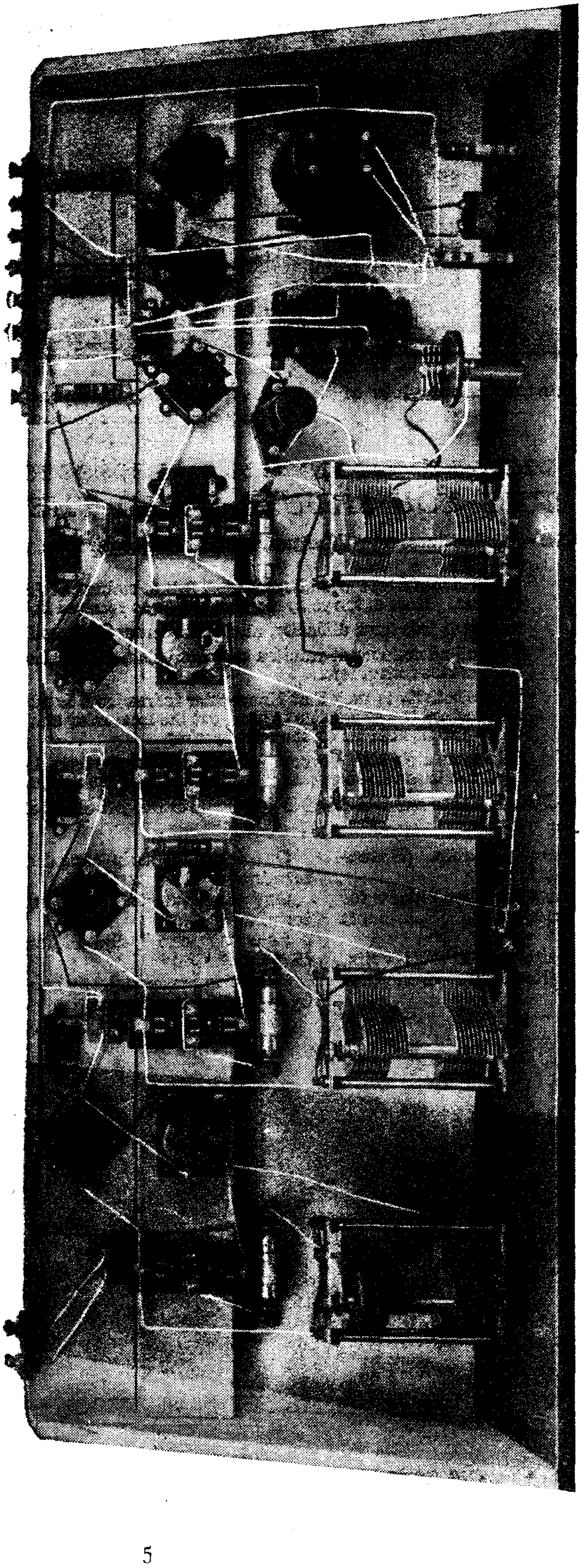
Four 100,000 ohm anode resistances with bases. (Varley Magnet Co.)

One Ever Ready 9-volt battery. (Ever Ready Co.)

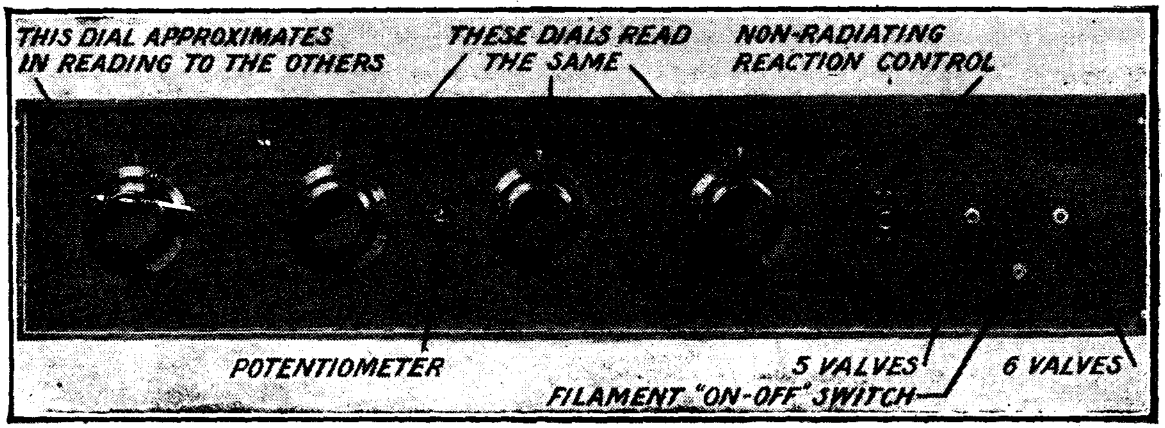
Six valve holders. (Benjamin Electric, Ltd.)

Four Dimic bases. (L. McMichael, Ltd.)

(The coils will be specified later.)



This photograph should be used in conjunction with the wiring diagram Fig. 4. Note that the "Dimic" coils and neutralising condensers are mounted on a raised wooden strip.



A front of panel view of the "Elstree Six." By means of jacks the last valve can be cut out when desired.

WHY YOU SHOULD BUILD THE "ELSTREE SIX."

BECAUSE—It is the finest set yet designed for the home constructor, and is unapproached by any American receiver.

It will give you on the loud-speaker all B.B.C. main and relay stations, together with the Continental stations. Most of the relay stations can be so received in broad daylight.

Tuning is free from difficulty, all the condenser dials reading approximately the same.

The full advantages of reaction are obtainable, and yet the receiver cannot radiate, thereby causing interference with others.

The selectivity is such that Manchester is free from London at a distance of 1½ miles from 2LO. At Bradford it was possible to tune-out the local relay station 200 yards away and to receive many other distant stations on the loud-speaker.

It is completely stable over a band of wavelengths from 150 metres to wavelengths above any yet used for broadcasting without readjustment of the neutralising condensers.

Four single coil mounts. (Burne-Jones & Co., Ltd.)

Three neutralising condensers for baseboard mounting. (Peto-Scott Co., Ltd.)

Six Amperites. No. 1A (6 volts, .25 amps.) (Rothermel Radio Corporation.)

One terminal strip containing 8 terminals.

One terminal strip containing 2 terminals.

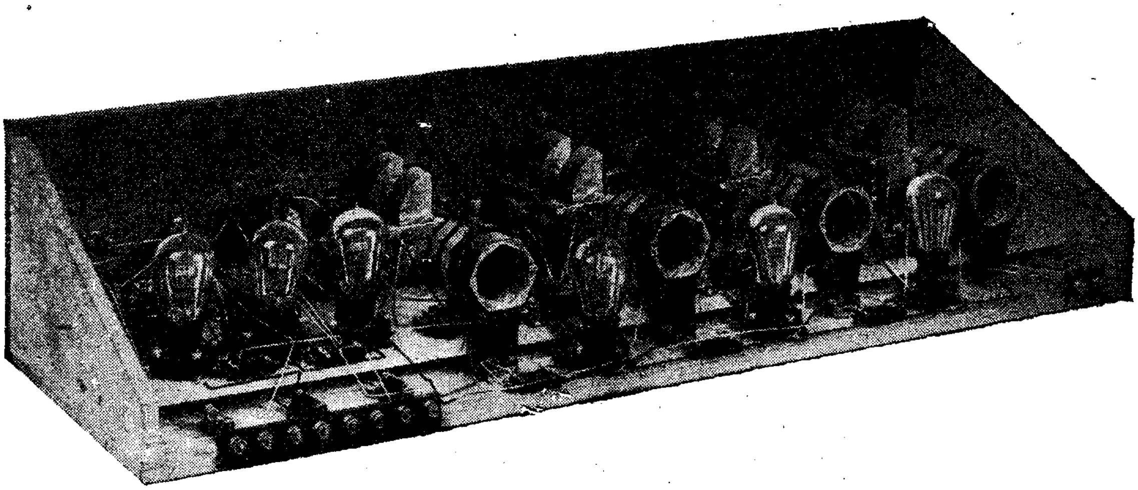
Four "Decko" dial indicators. (Bulgin & Co.)

One wooden panel, 42 in. long by 9 in. high. (Camco.)

One wooden baseboard, 42 in. long by 13½ in. deep, with side brackets for supporting the panel. (Camco.)

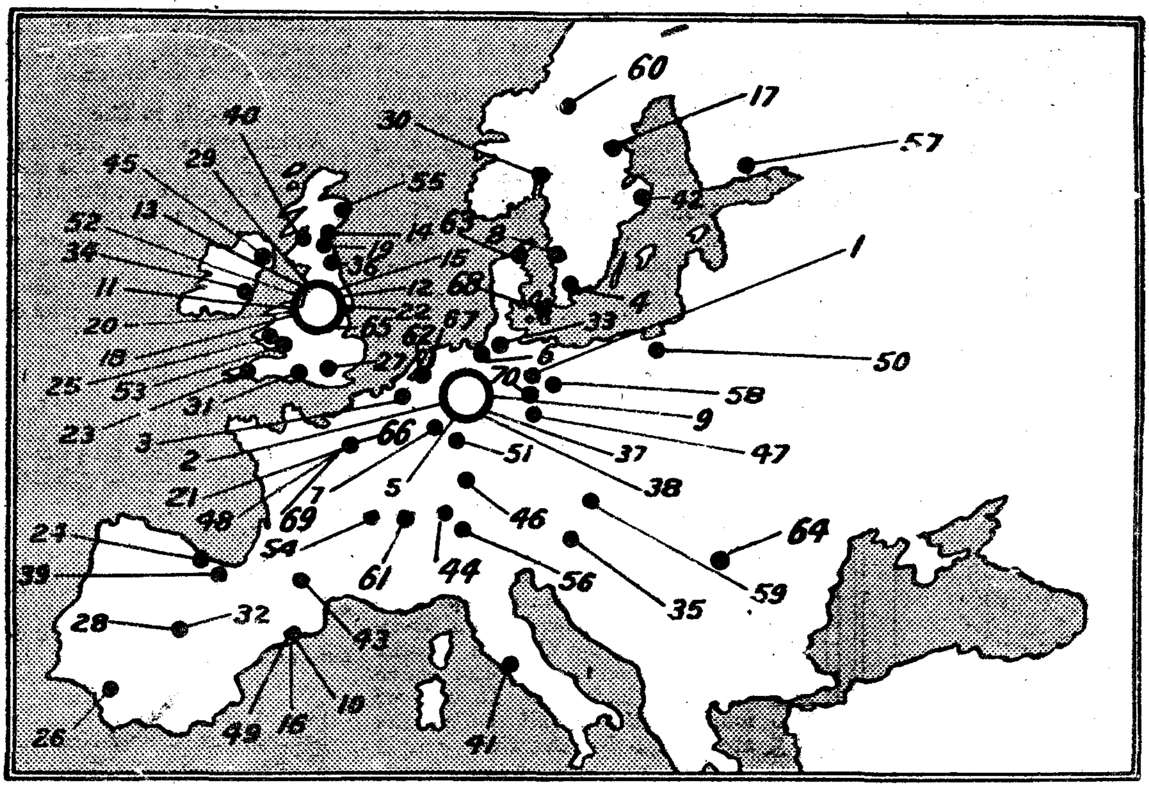
One wooden board, 42 in. long 2¾ in. wide, raised 1¼ in.

Six .002 fixed condensers type 600. (Dubilier.)



Interchangeable coils are used throughout the receiver, which is suitable for use over a remarkably wide band of wavelengths.

A list of seventy stations received on the loudspeaker, together with their dial readings, is given below. You can get these.



THE "ELSTREE SIX" TEST REPORT.

Station.	Range 1.	Station.	Range 2.	Station.	Range 2.	Station.	Range 2.
1 Stettin ..	.. 90	19 Edinburgh ..	72.5 (129)	36 Newcastle ..	95	53 Swansea ..	119
2 Elberfeld ..	.. 95	20 Liverpool ..	73 (130)	37 Munster ..	96	54 Lyons ..	120
3 Brussels ..	.. 100	21 Petit Parisien	74 (131)	38 Breslau ..	97	55 Aberdeen ..	121
4 Malmo ..	.. 103	22 Hull	75.5 (132)	39 Bilbao ..	98	56 Zurich ..	124
5 Cassel ..	.. 104	23 Plymouth ..	76 (133)	40 Glasgow ..	99	57 Helsinfórs ..	128
6 Bremen ..	.. 106	24 San Sebastian	78 (136)	41 Rome ..	101	58 Berlin ..	131
7 Dortmund ..	.. 108	25 Cardiff ..	80 (140)	42 Stockholm ..	102	59 Vienna ..	135
8 Göteborg ..	.. 110	26 Seville ..	82	43 Radio-Toulouse	103	60 Ostersund ..	..
9 Hanover ..	.. 112	27 London ..	84	44 Berne ..	104	61 Geneva ..	..
10 Barcelona ..	.. 114	28 Union Radio-		45 Belfast ..	106	62 Hilversum ..	..
	Range 2.	Madrid ..	86	46 Stuttgart ..	107	63 Hjorring ..	..
11 Stoke ..	66 (117)	29 Manchester ..	87	47 Leipzig ..	108	64 Karlsborg	..
12 Sheffield ..	67 (118)	30 Oslo	89	48 Ecole Superieure		65 Daventry ..	..
13 Bradford ..	68 (120)	31 Bournemouth	90		109	66 Radio-Paris ..	..
14 Dundee ..	70 (122)	32 Radio-Iberica	91	49 Radio-Catalana	110	67 Amsterdam	..
15 Leeds ..	70.5 (124)	33 Hamburg ..	92	50 Koenigsberg	111	68 Sorö	..
16 Radio-Barcelona	71 (126)	34 Dublin ..	93	51 Frankfort ..	112	69 Eiffel Tower	..
17 Gavle ..	71.5 (127)	35 Graz ..	94	52 Birmingham	114	70 Berlin ..	..
18 Nottingham ..	72 (128)						

One mahogany cabinet, American pattern. (Camco.)

The Small Platform

As has been previously stated, the high-frequency transformers are made up of Dimic coils for the secondary, and plug-in coils for the primary. It is necessary therefore to mount the Dimic coils on a small raised platform in order to bring the axis of the coils level with the axis of the plug-in primary. This same board is used to carry three limiting resistances for the filament leads, and the neutralising condensers.

Amperites have been used in place of the usual filament resistances. These are ballast resistors which maintain the current through the valve constant, irrespective of small variations in the voltage of the accumulator. They also serve to prevent damage to the valve by any accidental increase in the voltage.

A Wooden Panel Utilised

It will be observed that a wooden panel has been employed. This is a distinct saving in cost, and all the components which are mounted on the panel are at earth potential (as far as any H.F. is concerned), so that the use of wood is perfectly satisfactory. With the particular dual condensers employed, the spindle of the condenser, which is the portion in contact with the panel, is definitely at earth potential. This has the further advantage in that it entirely eliminates any hand effects.

The only other components on

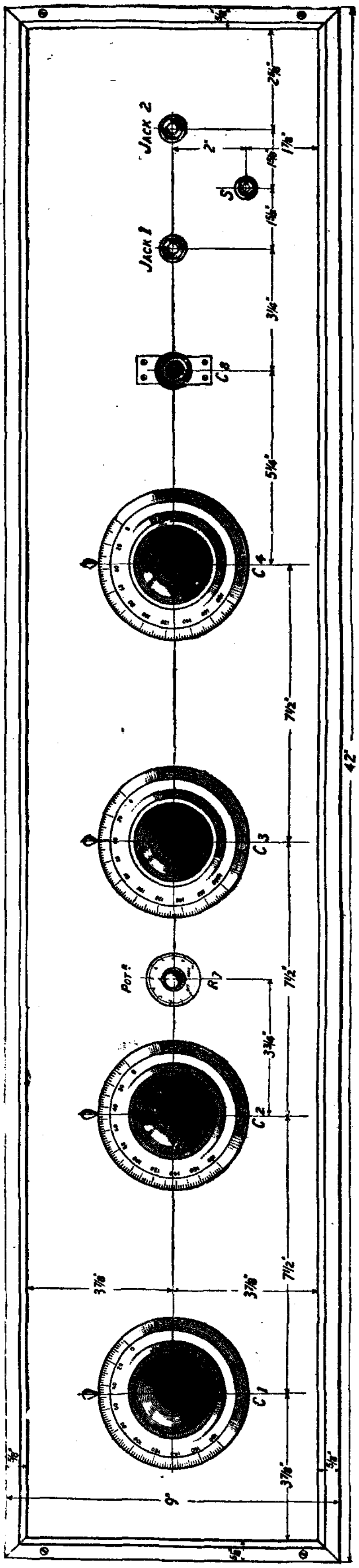


Fig. 3.—Blueprint No. 161a, giving the layout of the components on the panel, can be obtained from the Sales Department. Price 1s. 6d., post free.

the panel are the jacks, a filament switch and potentiometer, and the reaction condenser. The remainder of the receiver calls for little comment in the make-up. The fixed resistances of 100,000 ohms each, connected between the centre points of the coils and condensers respectively, are stowed on the baseboard proper just under the ends of the dual condensers.

Mounting the Components

In making up the receiver the four condensers should be mounted on the panel first of all, together with the other panel components. The Dimic coil holders, Amperites and neutralising condensers may then be mounted on the auxiliary baseboard. This baseboard may then be fixed in position, and the remaining components mounted on the baseboard.

Wiring Up

Wiring may now be started, and no difficulty will be experienced if the diagram given in Fig. 4 or blueprint 161b is followed. It is advisable to wire the filament circuits first, and then to wire each valve circuit individually. It will be found that since all the circuits are similar that the wiring can be made symmetrical for each circuit.

When the baseboard has been wired up the panel may be fixed in position and the wiring completed.

The receiver is now ready for test, and may be connected up, the usual preliminary tests being made for correctness of the wiring as far as the high and low tension circuits are concerned.

The Valves to Use

The valves employed in this receiver are not critical, and if necessary general purpose valves may be employed. Better results are obtained with high-impedance valves in the first four sockets, and in any case a special high-impedance or detector valve should be utilised for the rectifier. Suitable low-frequency power valves should of course be employed for the last two stages, but generally speaking the receiver will function well on a variety of different types of valves.

Recommended combinations are as follows: D.E. 5B for the first four sockets, and D.E.5 for the last two. D.F.A.4 for the first four sockets, and D.F.A.1 for the last two. D.3 H.F. and D.3 L.F., D.E.2 H.F. and D.E.2 L.F. and similar combinations of valves.

The receiver as made is strictly only applicable to valves running off 6 volt accumulators and taking a ¼ of an ampere, for the Amperites are at present only available in this size, or for the 60 milliamp type of valve. If it is particularly desired to use other types of valves, then one of the various makes of fixed resistors on the market should be used. Suitable values may be obtained from the makers.

Coils to Use

As has been stated, this receiver is stable from 150 to 5,000 metres. The coils required for the principal ranges are as detailed below. It should be noted that for each range four secondary coils will be required, three primary coils and a choice of two or three aerial coils.

Range 1.

150—450 metres.

Secondaries—Dimic No. 1.

Primaries—Burndept C or equivalent coils having 10 to 15 turns.

Aerial coil—Same as primaries.

Range 2.

250—600 metres.

Secondaries—Dimic No. 1A.

Primaries—No. 50 or equivalent coil.

Aerial coil—Nos. 30, 50 or 60 to suit aerial.

Range 3.

600—1,200 metres.

Secondaries—Dimic No. 2A.

Primaries—No. 200 or equivalent coil.

Aerial coil—No. 100 or 150 to suit aerial.

Range 4.

1,200—3,000 metres.

Secondaries—Dimic No. 3A.

Primaries—No. 300 or equivalent coil.

Aerial coil—No. 250 or 300 to suit aerial.

It should be noted that in all cases the Dimic coils are a size larger than those normally employed, because they are only tuned with an effective capacity of .00025 maximum, whereas the rating on the Dimic coils is worked out for a maximum capacity of .0005.

The Aerial Coil

The aerial coil should be chosen to suit the particular aerial. With a given coil there is usually a point where the tuning becomes very flat, and at this point a different size of aerial coil should be employed.

(To be continued.)

Do not fail to turn to Page 50 for details of the Editor's invitation to readers.

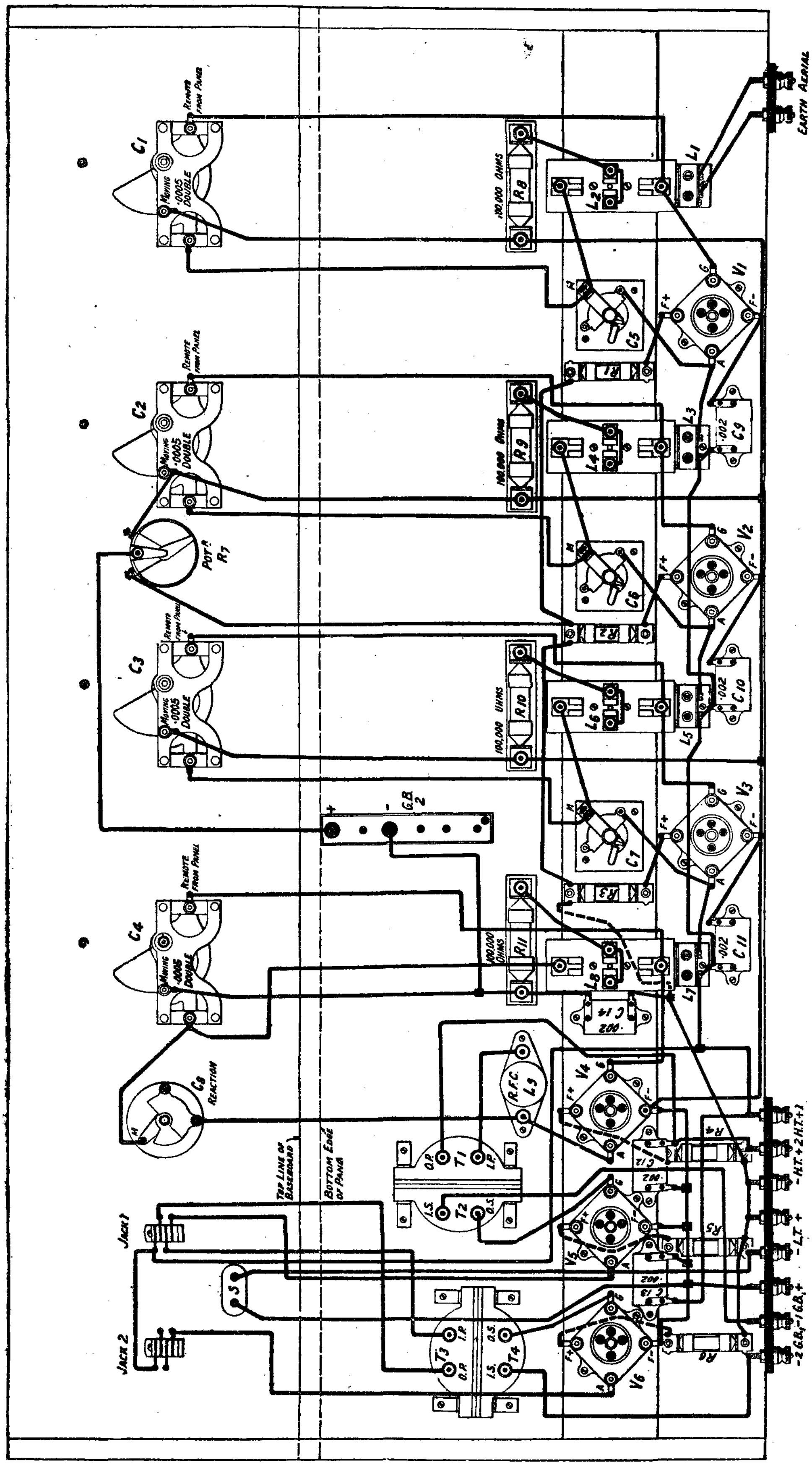
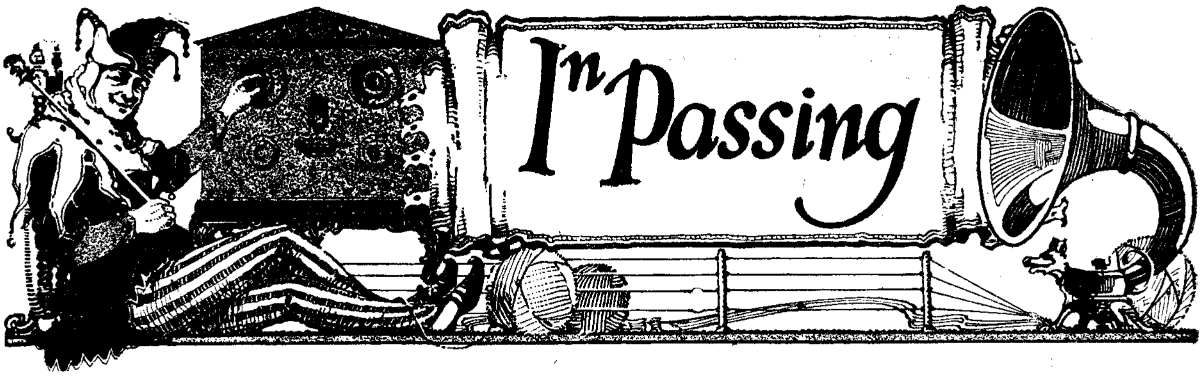


Fig. 4.—The wiring is simple and straightforward. Constructors may obtain the full size wiring Blueprint No. 161b. Price 1s. 6d., post free. The neutralising condensers require to be about one-third in, as shown.



PROFESSOR GOOP just now is simply full of bright ideas for increasing the comfort of the carriers of portable sets. If only his latest inventions obtain the wide popularity that they deserve, the racing man, the river girl, the picnicker, the motor-cyclist, the

Music wherever they go.

hop-picker, the winkle-sticker, the motorist, the tramp and the butterfly-catcher will be able to have music wherever they go with a minimum of trouble and of inconvenience.

"The Nest Egg"

The other night when I made my way round to The Microfarads, I found him busily engaged in perfecting one of his newest designs, which he has happily named "The Nest Egg." This is a unit set with two stages of high-frequency amplification, a rectifier and two note magnifiers. The case containing each unit is made one size smaller than that of the preceding one. Thus when you wish to pack up the set for transportation purposes you place the second high-frequency amplifier inside the first, the rectifier inside the second high-frequency amplifier, the first note-mag. inside the rectifier and the second note-mag. inside the first.

Could anything be handier or more compact? When he had disclosed his scheme to me I suggested as an improvement that each unit's cabinet should be made collapsible. Then when all had been packed one within another the whole thing could be folded flat and carried in the breast pocket. He saw at once that there was a great deal in this idea, and he is now elaborating it.

More Good Things

Another little invention of his that will shortly create somewhat of a sensation in the wireless world is his new portable aerial which serves the dual purpose of wave-catcher and of a trouser stretcher. This little device, which he proposes to name "The Adonis," consists of wires sown into the legs of the enthusiast's trousers. Being arranged fore and aft, these wires produce and maintain the most perfect of creases whilst acting at the same time as efficient collectors of any oscillations that may be knocking about.

A Portable H.T. Battery

For the particular benefit of those young sparks who like to parade

Combined aerial and trouser stretcher.

seaside promenades in riding breeches a special model called "The Centaur" is to be made which increases the balloon-like effect so beloved by the horseless horsey. And then there is his cast-iron walking-stick, which makes a most effective earth connection, and his portable high-tension battery, whose cells are fitted into the compartments of a cartridge belt or a bandolier worn round the waist or over the shoulder of the peripatetic enthusiast.

A Waistcoat-pocket Set

He has also on the stocks a real waistcoat-pocket set. This fits most neatly into a special leather waistcoat, which is itself a sure stand-by in case the evening *should* be chilly. It is provided with a large number of pockets both in front and behind for containing the apparatus, and its buttons are formed by the various control knobs. As the waistcoat complete with all apparatus weighs but 136 lb. it forms an ideal addition to the equipment of any who are contemplating holidays afoot. And I must not forget to tell you about his portable loud-speaker, which, fitting neatly into a topper, enables its wearer to perform at will the feat of talking through his hat.

His Latest Receiver

But the most important news that I have for you is that which concerns the greatest of all the circuits so far designed by the Professor. This is his "Five-in-One" Super Reflex, the theoretical diagram of which is given herewith. A careful examination of the circuit will show that it contains some very remarkable features. It does, in fact, enable a single valve to perform the work of five, and so far no "toob" has gone on strike or demanded overtime for the job.

The Goop Effect

The circuit is based upon an amazing new discovery of the Professor's which, unless it is smothered by professional jealousy, will shortly be as well known as the Heaviside Layer, the Round Microphone, Nagaoka's Formula or the D.X. Conscience. This is the Goop Effect, one of the most

Talking through his hat.

amazing of the little habits of high-frequency currents that have yet been discovered. As the result of a vast amount of strenuous experimental work the Professor has confirmed beyond all possibility of doubt the theory which he formed some time ago that high-frequency currents manifest the phenomenon of *hodomorphosis*, or change of path.

If two possible paths are offered to a high-frequency current the Goop Effect will be produced. On its first time round it will invariably turn to the left, whilst in the second lap it will turn right-handed. Should yet another alter-

Enclosed in a clock case.

native path be provided in a straightforward direction current will take this at the third time of asking. The same remarkable effect is also manifested by currents oscillating at audio frequency.

In Detail

Let us now examine with the care which it deserves the theoretical circuit-diagram. At first it may look rather like an example of cat's-cradle; but do not let this put you off; I have seen much more complicated diagrams in my time. The aerial is tuned by means of the simple rejector circuit C_1L_1.

Incoming oscillations set up varying potentials upon the grid of the valve V which give rise to current fluctuations in the anode circuit. These turn to the left, passing through the coil L_3, which is coupled to L_2. They are thus transferred to the grid of the valve and pushed back for a second go of high-frequency amplification.

Having reached the anode once more they turn to the right and are passed *via* the gridleak and condenser C_2 R_1 to the grid. Owing to the action of C_2 and R_1 they are now rectified.

Alternative Paths

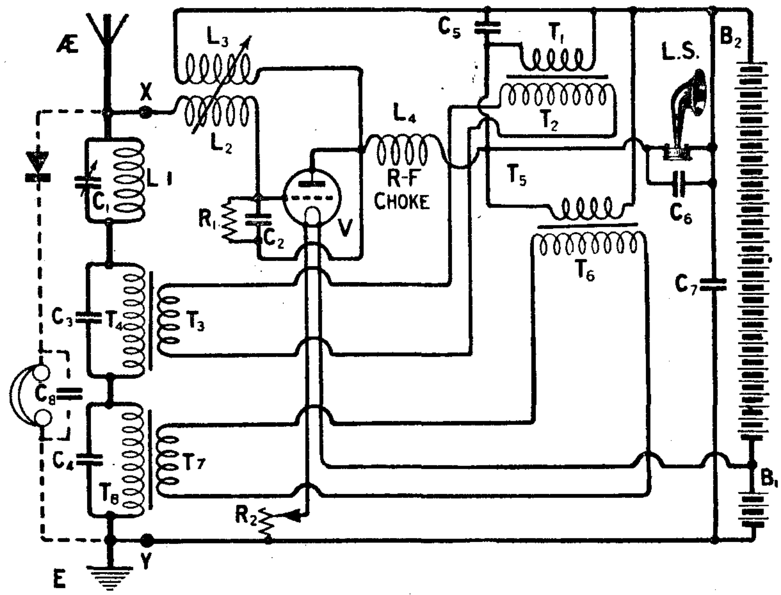
We come now to the third lap. The choke L_4, which serves to restrain any tendency of oscillations that rebel against Professor Goop's rule during the first two rounds, now provides an easy path for the audio-frequency impulses emanating from the anode. Turning to the left these pass through T_1, the primary of the first low-frequency transformer. The secondary of this transformer, T_2, is connected to the primary of another L.F. transformer, T_3 T_4, which passes the rectified oscillations back once more to the grid of the valve. Here they undergo audio-frequency amplification and run yet again into the anode circuit.

Turning this time to the right they make their way through the primary of the third L.F. transformer, T_5 T_6, whence they are transferred to the fourth, T_7 T_8, which duly delivers them to the grid for a second whack of note magnification.

Results

Having made first their left-handed and then their right-handed turn, the audio-frequency oscillations now take the straight path which brings them to the windings of the loud-speaker, which proceeds to deliver the goods to the ravished listener. It will be seen that incoming oscillations are amplified twice at high frequency and twice at low frequency, besides being rectified in the most approved manner.

The set thus amply justifies its name of "Five-in-One" by enabling one valve to be of five-fold utility. So completely stable is Professor Goop's new set that no sound can be heard even if the knob of C_1 is moved rapidly backwards or forwards. So amazingly selective is it that it is guaranteed to cut out not only the local station but also every other station in the published lists. The high-tension battery, B_2, is normally one with a terminal potential of 100 volts, but not the slightest difference is made to the stability of the set if this is increased to 5,000 volts or more.



The circuit diagram of Professor Goop's "Five-in-One" Super Reflex. Note that it contains some *remarkable* features.

Difficult Tuning

The beginner, or even the old hand for that matter, will find it so exceedingly difficult to do the fine tuning that is necessary with this knife-edge set that he is strongly advised to wire up and to use for some weeks the circuit shown in dotted lines. When this has been done the set becomes one of the most economical known, for the valve V may be switched off without making the slightest difference to results. The circuit will work perfectly well if disconnections are made at the points marked X and Y in the diagram, and better still if the transformer secondaries T_4 T_8 are removed altogether. Even in this simplified form the set is warranted to bring in any station in the British Isles, on the Continent, or even in America, provided that it is being relayed by 2LO.

For Indoor Work

For indoor use its possibilities are unlimited. Other designs have made it possible to build a loud-speaker into the set; it is quite simple to build the Goop "Five-in-One" into the loud-speaker. It may even be enclosed in a clock case or in any old thing which takes the constructor's fancy.

The Valve

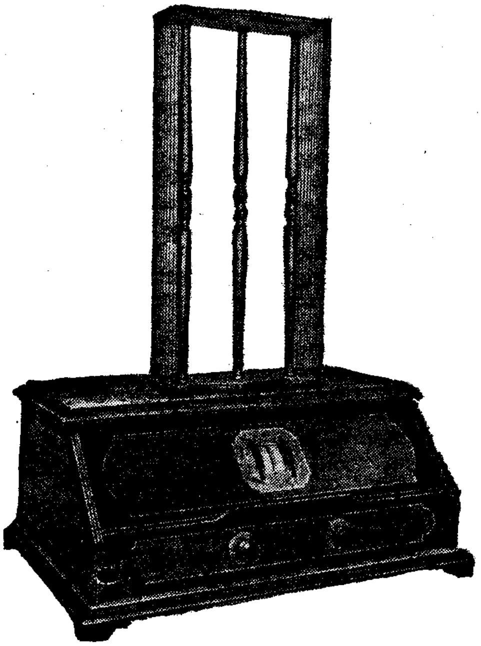
Professor Goop and I in the course of our experiments found that the performances of the set were very greatly influenced by the type of valve used. Since V has

Progress in American Receiver Designs

Interesting New Models

By

PERCY W. HARRIS, M.I.R.E.



The Radiola 25 is a six valve super-heterodyne receiver. The tuning controls can be adjusted simultaneously with one finger.

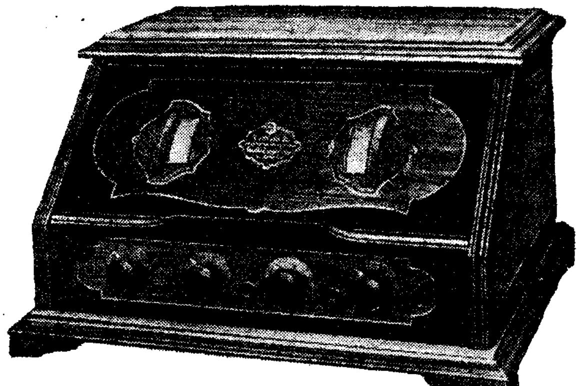
WHILE the last few years have shown steady progress in the design of American radio receivers for broadcast reception, the external appearance has not changed to any great degree until the present season. Indeed, in the last year or two, the great majority of factory built broadcast receivers of American origin have consisted of a long cabinet with a black front panel bearing three dials, a switch or two, and perhaps a jack for telephones. These latter however are now practically obsolete in America, for everyone desires reception on a loud-speaker.

Five Valve Receivers the Most Popular

Circuits have remained very similar for some time, the biggest popularity having been obtained by the five valve combination with two stages of tuned radio frequency (generally neutralised), detector and two stages of transformer-coupled note magnification. A limited popularity has been enjoyed by the super-heterodyne, but as instruments containing this circuit are a monopoly of one corporation, there has not been the same variety of designs as have obtained with the neutrodyne and similar arrangement. Having reached a point where both selectivity and good volume are features that can be claimed by practically every high-grade commercial set, manufacturers have been turning their attention to other improvements in ease of control, additional sensitivity and better tone combined with a more pleasing exterior appearance to the set.

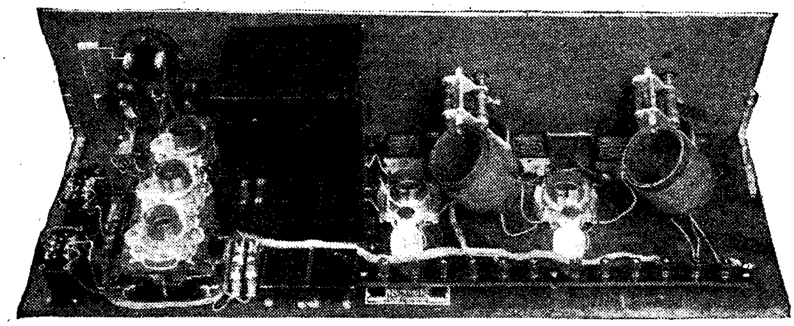
Recent Models

In this article you will find illustrated a few of the later models of American receivers, which may be taken as representative of the general trend of design at the present time. Beginning with the latest model super-heterodyne, several important differences will be noticed. For example, in the Radiola 25, the first illustration in this article, the conventional "instrument" style of wireless receiver is no longer evident. The cabinet containing the super-heterodyne suggests a closed writing desk more than a scientific instrument, while the frame aerial or "loop," to give it its American name, is gracefully poised above the centre and is of a shape quite distinctive and by no means unpleasing. So far as the circuit is concerned, six valves are used, reflexing being adopted to give additional audio-frequency volume.



In the Radiola 20 five valve receiver the three grid circuits are provided with a simultaneous tuning arrangement, the dial of which can be seen on the left of the above photograph. The companion dial on the right controls the reaction effect.

The wavelength range is approximately 220 to 550 metres (a range of wavelengths which we should no longer consider adequate in this country for such an instrument), while the two dials for controlling the oscillator frequency and the tuning of the frame aerial circuit are placed side by side in an edgewise position, forming narrow drums.

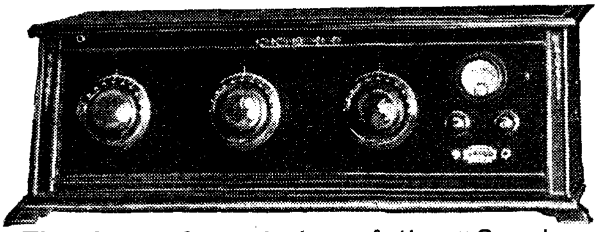


The makers of the "Garod Five" have adopted a method of wiring whereby certain leads are "bunched." The accessibility of the completed receiver can be appreciated from the photograph.

This disposition of the two dials enables both to be moved simultaneously with one finger, and as straight line *frequency* condensers are used, the necessary difference in frequency between the two circuits is maintained when the two dials are rotated simultaneously. To get a still finer adjustment, either dial can be rotated separately, but generally, once the proper relative difference between readings has been obtained, this difference can be maintained with "one hand control."

Calibration an Easy Matter

Alongside of each dial edge is a space on which pencil notes for degrees and station markings can be made. This makes the calibration of the instrument an easy matter and is proving a very popular feature.



This front of panel view of the "Garod Five" shows that the makers still adhere to the popular three dial method of tuning.

When dry battery operated, all batteries are contained within the cabinet, but if necessary the makers can supply a complete equipment for working entirely from the A.C. mains without any separate batteries whatever.

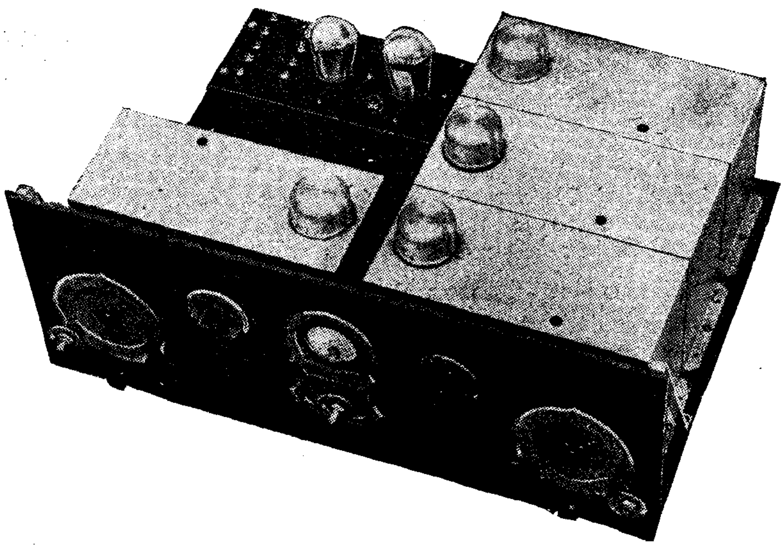
A New Valve

In passing it may be mentioned that the Radio Corporation (the makers of the Radiola receivers) have developed a new valve known as the UX 120 which, with a filament voltage of 3, takes but .125 of an ampere current, and with an anode voltage of 135 requires no less than 22.5 volts grid bias, the anode current in such circumstances being 6.5 milliamperes. The valve is designed for the last stage in the audio amplifier and gives remarkably good reproduction.

Simple Control a Feature

The same Company, and probably for the purpose of competing with the five valve neutrodyne receiver, has also developed a five valve receiver, known as Radiola 20, with two stages of neutralised high frequency, a detector and two stages of transformer coupled note-magnification, the tuning condensers for the first, second and third grid circuits respectively being simultaneously operated by one edgewise dial shown on the left of the second photograph. A corresponding edgewise dial on the right-hand side of the instrument controls reaction in the detector circuit, a feature not present in the standard neutrodyne receiver sold in America. The wavelength range of this instrument is 200 to 550 metres. The circuit has not been published, but I believe the Rice method of neutralising is used, the arrangement being thus very similar to the circuit used in the "Special Five" published last November. This is one of the few American receivers now

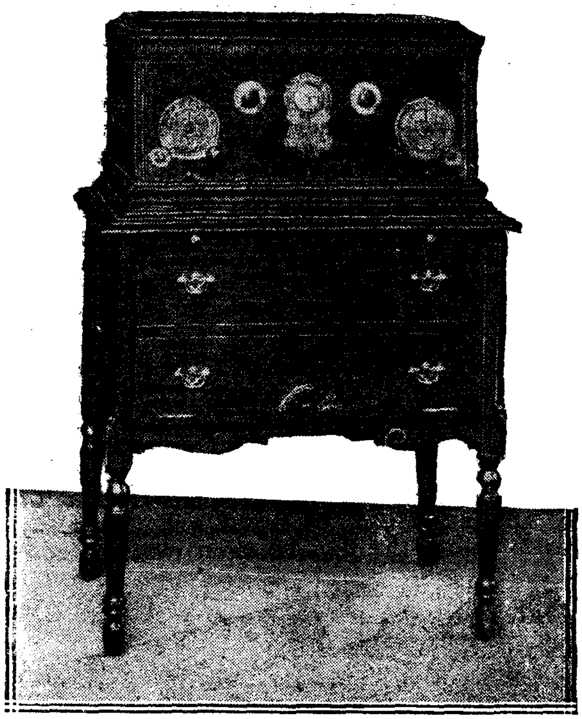
In the Stromberg-Carlson six-valve neutrodyne even the valves are screened. In these circumstances the set is completely stable when the aerial and earth are removed.



provided with telephone jacks, and these will be observed on the front of the receiver. Two voltmeter jacks are also provided so that the valves can be adjusted correctly for filament voltage. The H.T. current taken by this instrument is approximately 12 milliamperes, whereas with the super-heterodyne just referred to the current is slightly more.

An Interesting Point

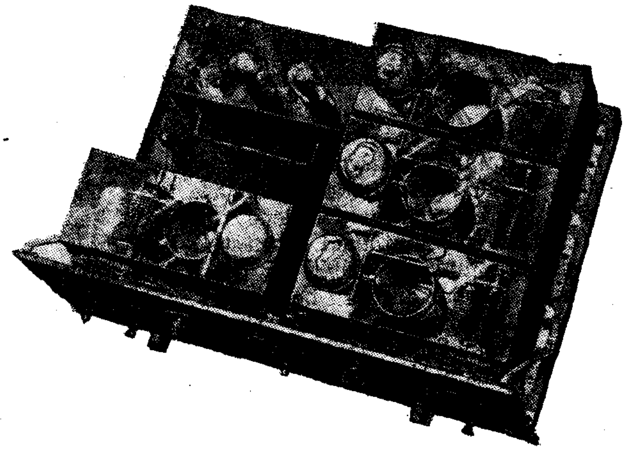
In the neutralised class of receiver, a number of firms are still manufacturing the popular three dial model with sundry slight modifications and improvements, and the benefit of careful screening to avoid interaction between various circuits is being more fully realised. For example, in the "Garod Five" receiver, illustrated in this article, one of the high-frequency transformers is carefully screened, while other novel features include the "bunching" of the wiring of those leads which can be brought together without harmful interaction. The position of the screen referred to and the method of bunching the wires are clearly evident in the illustration.



The handsome external appearance of the Stromberg-Carlson receiver makes it worthy of a place in the most luxurious of drawing rooms.

The Stromberg-Carlson Receiver

A fine example of the latest type of neutrodyne in which screening is extensively indulged in is the Stromberg-Carlson six tube neutrodyne, in which three stages of radio-frequency amplification completely neutralised, a detector and two stages of audio frequency are used. Three photographs in this article illustrate, one, the exterior appearance of one of the models; another, the interior with the screens in place, and a third, a partially sectioned instrument showing the arrangement of the parts within the screen. In order to simplify operations, three of the tuning condensers are operated on a single shaft (right-hand dial), while the condenser tuning the first grid circuit is separately operated, as the reading of



Here we see a partially sectioned view of the Stromberg-Carlson receiver showing the arrangement of parts within the screen.

this is frequently slightly different from that of the other, owing to differences in aerials. The action of the screens makes it unnecessary to give the characteristic tilt to the transformers—a feature which makes the average Hazeltine neutrodyne easy to recognise.

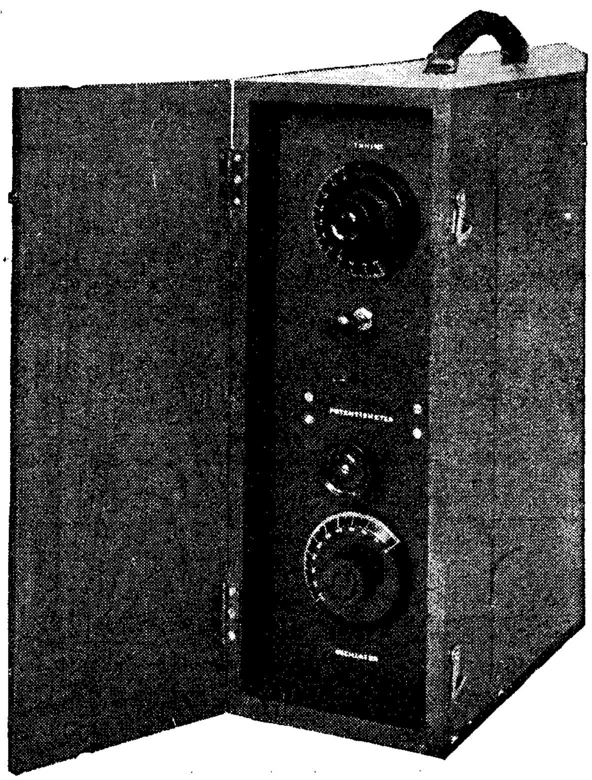
High Amplification Claimed

The wavelength range of the Stromberg-Carlson receiver is 195 to 555 metres, and it is claimed that an average voltage amplification of 10 per stage in a radio-frequency circuit is obtained. An interesting point is that during experimental work it was found that if the valves were left outside the shield, there was considerable pick-up and lack of stability. When the valves were screened complete stability was obtained, even when aerial and earth were disconnected. It should be pointed out here that many American receivers are only partially neutralised and require the damping of the aerial and earth connection to give the necessary stability in practice. In the receiver we are describing neutralising was carried out so effectively that the set is still stable when aerial and earth are disconnected. The Stromberg-Carlson Telephone Manufacturing Co. are not the only firm who are placing this six valve neutrodyne on the market, other firms manufacturing this at the present time being the Howard Radio Co. and the William J. Murdock Co., both well-known radio manufacturers. While the radio-frequency side of these receivers is much the same, in the Howard Company's instrument seven valves are used, the extra valve being a third audio-frequency amplifier.

Why Use a Separate Oscillator?

By G. P. KENDALL, B.Sc.

Mr. Kendall discusses with impartiality the relative merits of the various oscillator methods available to the designer, indicating the circumstances in which one method or another is to be preferred.



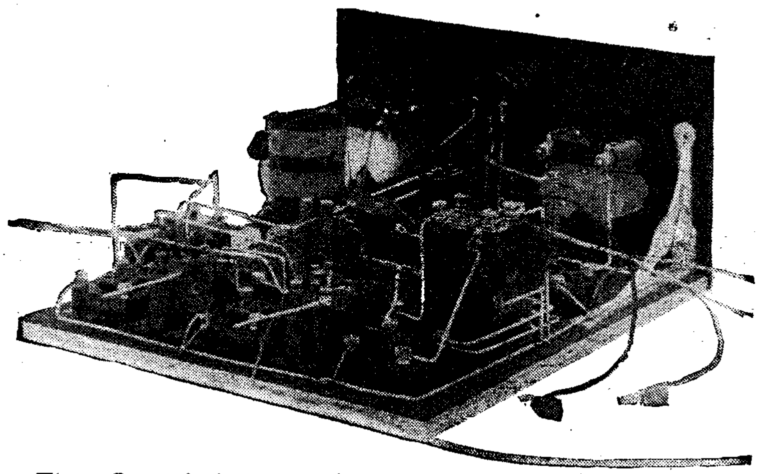
This portable superheterodyne receiver, designed by the author, utilises a separate oscillator.

THERE are, among superheterodyne enthusiasts, two rather clearly defined schools of belief, one pinning its faith to a separate valve as oscillator, and the other swearing by a combined oscillator-detector. So conflicting and also so plausible are the arguments put forward by each side, that the point must be one capable of causing considerable perplexity to the experimenter who has not had very much experience of superheterodyne work; one commonly hears such remarks as "Oh, I would never use a separate oscillator because it simply wastes a valve and does not give the same selectivity which one can get with a good autodyne," and "It is well worth while to pay the price of an extra valve to be rid of the nuisance of that abominable invention, the combined oscillator-detector. I have tried all the various Tropadyne and other autodyne schemes, and they are all noisy and unreliable and tend to squeal on the shorter wavelengths of the band."

Saving a Valve

As an experimenter who at one time belonged to one school and has now turned his coat and gone over to the other, perhaps my views may assist some readers to see that it is not a matter of straightforward choice between two schemes, of which one is obviously better than the other, but rather it is a question of choosing the most suitable scheme for certain particular purposes.

First and foremost, it is not simply a question of saving a valve by using a combined oscillator and detector, for were that the only attraction, I do not think that such schemes as the Tropadyne would ever have achieved the popularity which they have undoubtedly won. Assuming, however, for the moment, that the only attraction of the combined oscillator-detector is the saving of a valve, let us consider whether it is really worth while in all cases.

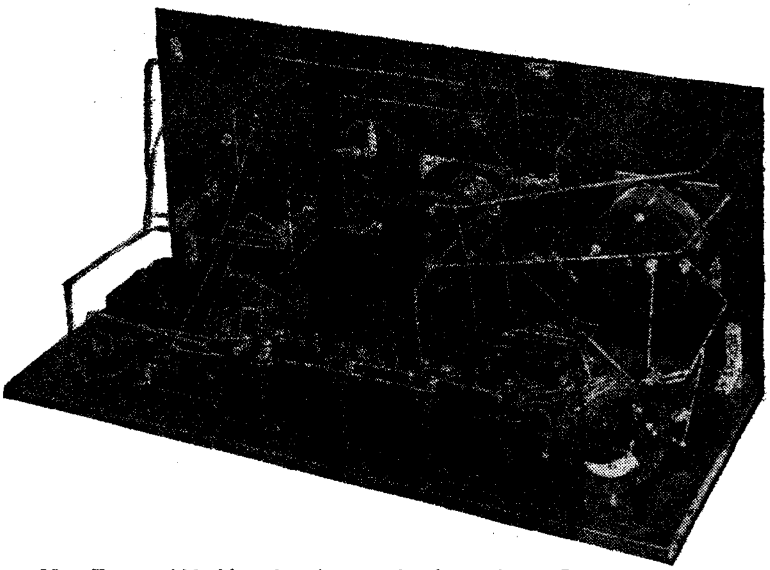


The "Superheterodyne for the Open Air," described by Mr. Kendall in the last issue of this journal, makes use of the combined detector-oscillator system.

The Deciding Factor

Evidently the deciding factor will be the proportion of the total number of valves in use represented by the single valve in question, and it should be remembered that the tendency in modern superheterodyne design is to reduce the total number to a figure which would have been quite unpractical, say, twelve months ago. A year ago nine or ten valves was considered quite a reasonable number to obtain anything like good results from a superheterodyne, and then probably the saving of a single valve was not worth the trouble involved in making the necessary arrangements.

More recent sets will be found to incorporate six or seven valves as the maximum, such sets, with the modern high amplification-ratio valves and more efficient intermediate-frequency transformers, being capable in ordinary conditions of giving practically everything that is wanted, providing that a combined oscillator-detector is used. In such a case it is obvious that the saving of one valve is quite a serious consideration and an oscillator-detector is, therefore, often found in portable sets where the extreme of simplicity and compactness is wanted.



Mr. Percy W. Harris, in designing the "Super Seven," chose the separate oscillator method.

Efficiency

It would seem that in the more recent types of superheterodynes with a limited number of valves, the elimination of one of the number by combining the functions of oscillator and detector is at least worthy of serious consideration from the point of view of economy, and it will be seen that the choice will be made upon the question of the relative efficiency and convenience of a separate oscillator and an oscillator-detector.

The idea is prevalent that combined oscillator-detectors such as the Tropadyne are difficult to get into satisfactory operation, and that they are decidedly tricky at the best of times. Some of the combined schemes are undoubtedly rather prone to be freakish, but the difficulties are by no means insuperable, and some very simple modifications in the original circuit will produce a perfectly practical arrangement, only requiring certain very simple adjustments to make it work properly.

Grid-leak Howls

One of the many difficulties of the autodyne circuit is that it is desirable that the valve should oscillate quite strongly and, therefore, one uses a large number of turns upon the reaction winding; hence the valve is somewhat prone to set up a grid-leak howl at the lower condenser settings. An example of a circuit which is especially liable to this trouble may be found in the "superautodyne" scheme at one time used by Messrs. Silver-Marshall which when built by the amateur was certainly a rather tricky proposition.

The Tropadyne in its original form was also somewhat prone to make trouble, although not so seriously as to cause very much difficulty, the simple expedient of using two interchangeable oscillator-couplers for the upper and lower halves of the broadcast band being a satisfactory solution. Alternatively, a tapping could be provided upon the reaction winding, so that fewer turns could be used for the lower settings of the oscillator tuning dial, the only objection to these expedients being that they introduce a certain amount of complication into the working of the set.

Remedies

Various schemes have been devised, however, for removing this trouble, the use of a relatively low value grid-leak in the Tropadyne circuit being one of the most successful of these. If a resistance of 100,000 ohms is used, it is quite easy to choose such a number of reaction turns upon the oscillator-coupler that the valve oscillates sufficiently strongly over the given range and yet it does not squeal until an extremely low dial setting is reached, at which one would not in any case be working.

It can be accepted that with a little patience in adjusting the number of turns upon the reaction winding and so on, a combined oscillator-detector using something resembling the original Tropadyne circuit can be persuaded to give quite straightforward and satisfactory operation, and many people find that the results which they obtain from this scheme seem to be very decidedly better in certain respects than those obtainable from a separate oscillator in an otherwise similar receiver. For example, the degree of selectivity obtained from the oscillator-detector circuit is, for some reason which is not very apparent, often of a higher order than is very easy to obtain with a separate oscillator unless the latter is working under absolutely ideal conditions.

Separate Oscillators

The attraction of the separate oscillator arrangement is to be found in the fact that no particular care is needed to make it operate correctly, so that any valve, any H.T. value and so on may be used, no critical adjustment being needed. These, no doubt, are serious considerations from the point of view of a man who wants to put together easily a superheterodyne which he can depend upon to work satisfactorily the moment it is completed.

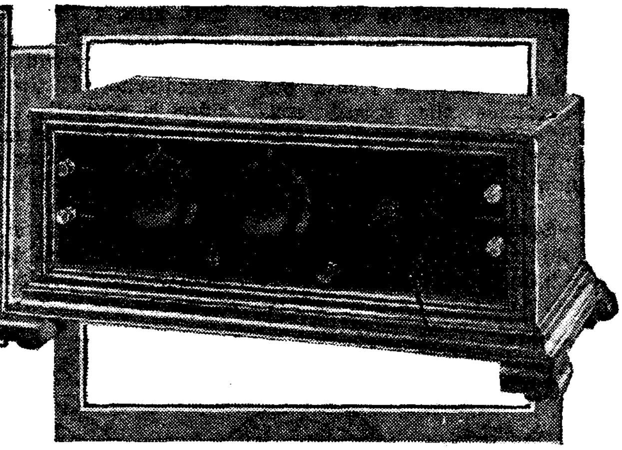
From the point of view of the set designer, moreover, who wishes everyone to be able to reproduce his original results with the very minimum of trouble and adjustment, the separate oscillator valve is a highly advantageous scheme, and it is, perhaps, understandable that many people who are quite aware that the oscillator-detector is capable of giving very fine results when once properly adjusted should, nevertheless, recommend the separate valve as being relatively certain to work properly at the first attempt. It does undoubtedly remove one of the doubtful factors from the complete superheterodyne, since it would be foolish to deny that the oscillator-detector does require some care in the choice of valve and in adjusting the H.T. voltage and filament current, etc.

Summary

To sum up, it would seem that it must be admitted that when the user of the set is prepared to spend a little time in making adjustment and choosing certain values correctly, the oscillator-detector possesses sufficiently great

(Continued on page 95.)

A TWIN-COIL THREE-VALVE RECEIVER



By
C. P. ALLINSON, A.M.I.R.E.

Describing the construction of a receiver both handsome in appearance and efficient in use, with the added merit that it is of the non-radiating type.

IT is surprising what can be done in the way of reception with three valves. Although the usual detector and two-note mag. receiver has a considerable following, nevertheless for the successful reception of very distant or weak transmissions reaction has to be pushed to its limit. In many cases this will not only lead to distortion, but also where transformer coupled stages of low frequency amplification are being employed, low frequency oscillations are liable to be set up, which is, to say the least of it, considerably irritating to the experimenter.

A Stage of H.F. Amplification

In a receiver intended for general use which may either be used for loud-speaker reception of the nearer transmissions or for headphone reception at satisfactory strength of distant stations, it is generally advisable to include a stage of high-frequency amplification. In the receiver to be described, three valves are employed, the first as a high-frequency amplifier, the second as a rectifier and the third as a low frequency amplifier.

Results Obtainable

Under favourable conditions it is possible to receive five or six stations on the loud-speaker with this set, while numerous transmissions are received at varying strengths on the headphones. In many cases this performance may be considerably exceeded, in others it may be difficult to equal, but this depends to a very large extent not only on local conditions, but on the skill of the operator and the efficiency of the aerial in use.

The photographs of the completed receiver show that a neat and pleasing layout has been given to the front of the panel, while the number of controls thereon has been reduced to a minimum for the purpose in mind.

Disposition of Controls

The two large dials are for the tuning condensers, marked C_1 and C_3 in the theoretical circuit diagram shown in Fig. 1, while the extension handle seen on the right hand side is for the neutralising condenser C_5, by means of which reaction is obtained. At the bottom of the panel will be seen the on-and-off switch on the left, and the variable grid leak for the detector valve on the right, while the two terminals on the left are for aerial and earth, and those on the right for the loud-speaker.

The reduction of the number of

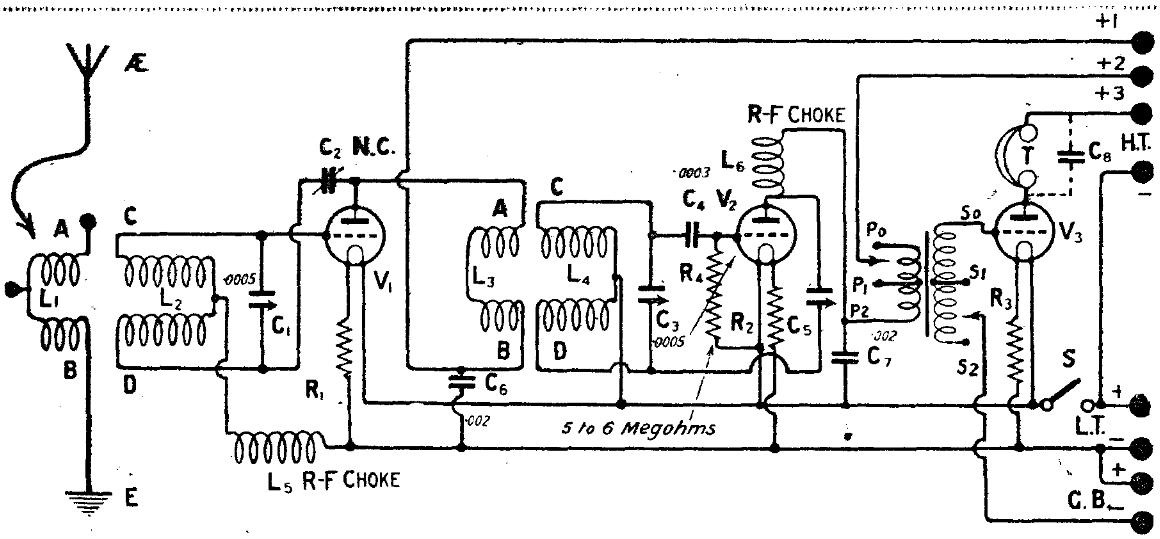


Fig. 1.—The circuit diagram of the receiver. The "Reinartz" type of reaction is used, reaction being controlled by means of the condenser C_5, a small neutralising condenser.

components mounted on the panel not only enhances its appearance, avoiding the overcrowded effect that might otherwise result, but also simplifies the actual construction, especially for those who have not had a great deal of experience in work of this description.

Special Coils Used

A point of special interest is the type of inductance coils which have

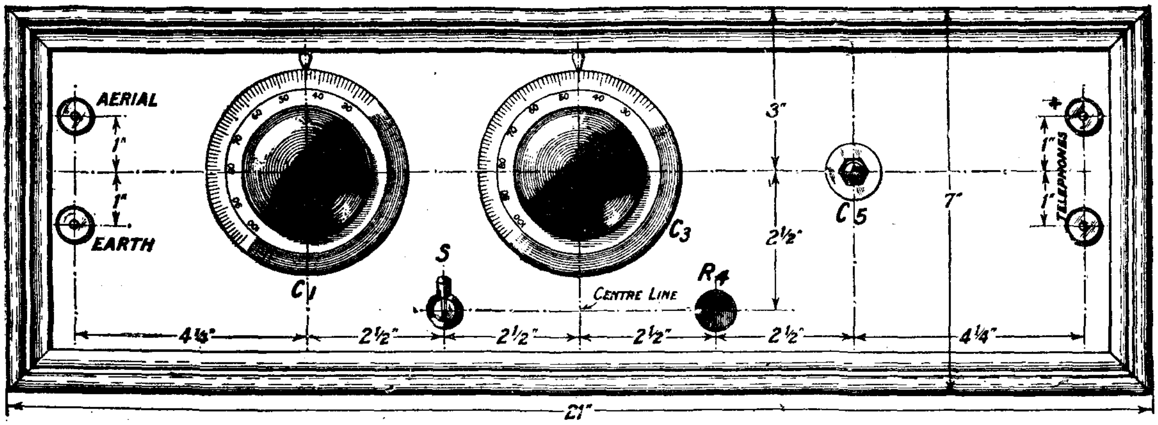


Fig. 2.—Drilling dimensions for the panel may be taken from this diagram, Blueprint No. 163a may be obtained free.

been used in this receiver. In the course of a series of experiments commenced some months ago in conjunction with fieldless coils, it was found that a decided increase in selectivity was obtained by the use of inductances of this description. This was of course due to the elimination of direct pick-up from the local station, which in this particular case (2LO being only 1½ miles away) is exceedingly severe. The coils employed, therefore, were decided upon after a considerable period of experimental work, and are for using on the lower broadcast band of wavelengths.

The photographs taken from the back of the panel indicate the appearance of these coils, which are seen to be of the "binocular" type. Each complete coil consists of two separate inductances, a small one for the aerial or anode coil and the other for a grid coil.

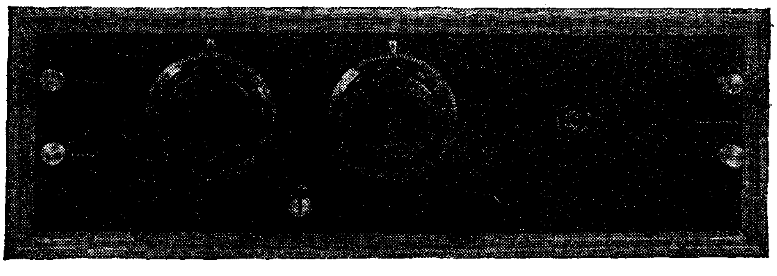
A Non-Radiating Set

Not only does the use of these coils reduce the direct pick-up from the local station, but also the interaction between the various stages is considerably lessened, so that even without some form of stabilisation, the tendency for a set constructed with these coils is to be stable and free from self-oscillation.

If a neutralising system is used, however, the advantage is obtained that, should the detector valve be made to oscillate by the use of reaction, energy will not be radiated from the aerial if the high-frequency stage is correctly adjusted. This, of course is of tremendous benefit when searching for stations, since it enables the carriers to be located without difficulty, and the transmissions tuned in with less trouble and in considerably shorter time than would otherwise be experienced.

The Theoretical Circuit

The exact circuit employed is shown in Fig. 1, from which it will be seen that the split-grid coil method of neutralising has been employed. In the case of the detector valve, one end of the coil is taken to the grid, the centre being connected to L.T. positive, the other end of the coil going to the anode through the



The layout of the panel is simple and attractive.

neutralising condenser C_5. The whole of the grid coil is tuned, and a choke L_6 in the anode circuit enables Reinartz reaction to be obtained.

It should be noted that the aerial may be connected either to half or to the whole of the aerial coil, a point that was found to be of decided advantage in the reception of widely differing wavebands.

On the low frequency side a multi-ratio low-frequency transformer has been employed, thus enabling a ratio to be obtained that best suits the valves used by the constructor.

Special Points

This set therefore presents several distinct advantages, which may be tabulated as follows :—

1. Reduction of direct pick-up to a minimum.
2. Stable high-frequency amplification and non-radiation when the detector valve oscillates.
3. Low-frequency side adaptable for use with any valve.
4. The aerial tap, which may be connected to either of two positions, allows the maximum efficiency to be obtained over the different broadcast wavelengths.

Below will be found the list of components required to make this receiver, and although the makers' names are given for the convenience of the constructor, it is not necessary to adhere to the particular makes used as long as components of known quality are substituted for those used by the writer.

You will require :—

One ebonite panel, 21 in. by 7 in. by ¼ in. (British Ebonite Co., Ltd.)

One oak cabinet for same with

baseboard 9 in. deep. (Pickett Bros.)

Two fieldless coils. (Lissen, Ltd.)

Two ·0005 Polar cam vernier variable condensers. (Radio Communication Co., Ltd.)

Two high-frequency chokes. (Beard and Fitch, Ltd.)

Three anti-phonic valve holders. (Burndept Wireless, Ltd.)

Three fixed resistors and sockets. (Burndept Wireless, Ltd.)

One baseboard mounting neutralising condenser. (Peto-Scott, Co., Ltd.)

One Neutrovernia condenser (Gambrell Br s., Ltd.)

One multi-ratio L.F. transformer. (Radio Instruments, Ltd.)

One ·002 fixed condenser. (Dubilier Condenser Co. (1925), Ltd.)

One ·002 fixed condenser. (H. Clarke and Co. (Manchester), Ltd.)

One ·0003 fixed condenser. (H. Clarke and Co. (Manchester), Ltd.)

One variable grid leak. (Beard and Fitch, Ltd.).

One fixed condenser, clip-in type, and mount. (L. McMichael, Ltd.)

Four large lacquered brass terminals.

One terminal strip.

Radio Press panel transfers.

N.B.—The resistances of the fixed resistors have not been given in this list, as this will depend upon the valves used, while the value of the fixed condenser which is connected across the output will again be different for different loud-speakers. Those who require this component will know from experience the best value to suit their loud-speaker, and this is the capacity which should be employed.

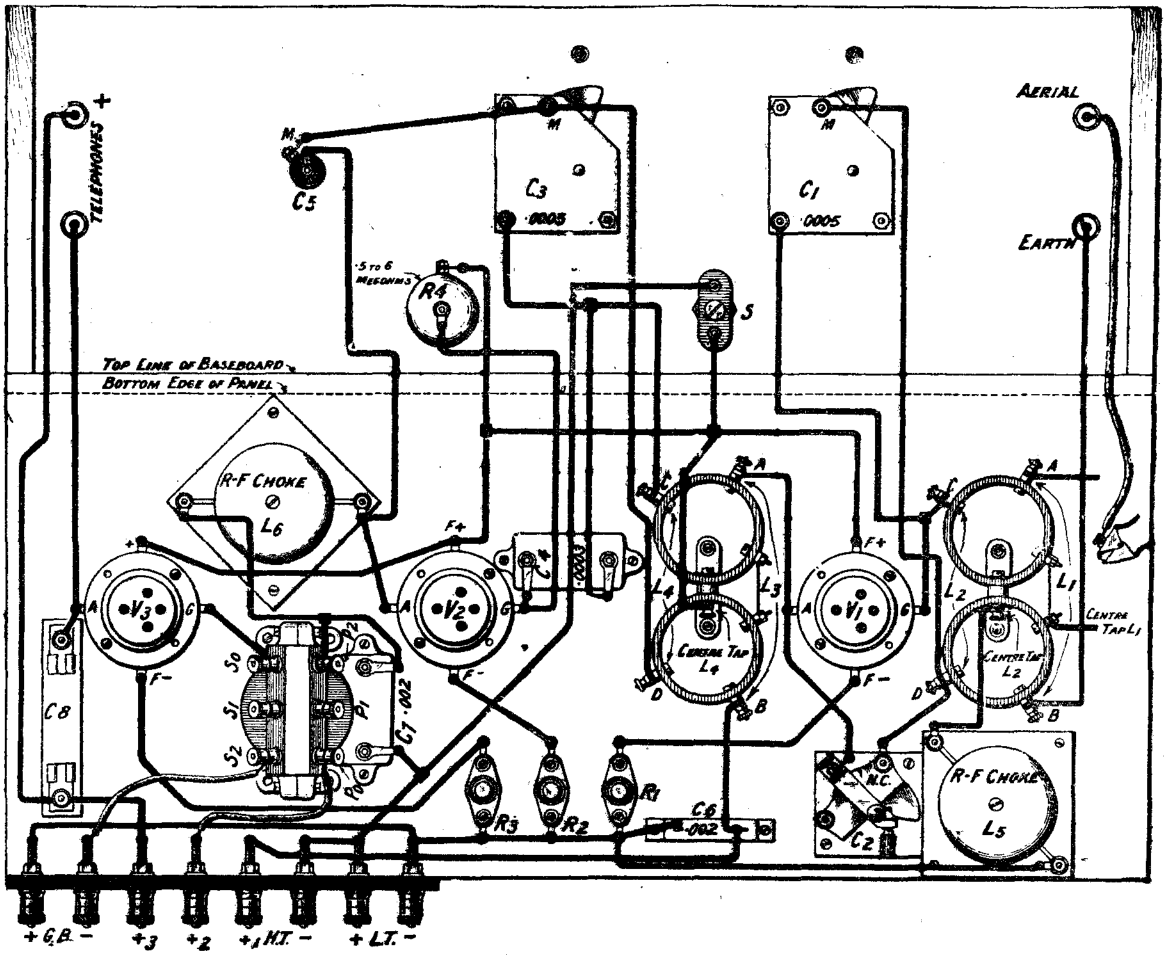


Fig. 3.—Note that the anode and grid leads to the valve-holders should be as short as possible. Blueprint No. 163b is obtainable free.

The Panel is soon Prepared

The first stage in the construction of this receiver is drilling the ebonite panel, and mounting thereon the components shown in the front of panel layout in Fig. 2. This drawing gives all the necessary dimensions and, further, is an exact reproduction to scale of the front of the panel. After this the various components which are fixed on the baseboard should be placed in position except the two twin coils and the L.F. transformer which should be left until part of the wiring has been completed.

The back of panel wiring diagram, shown in Fig. 3, also gives the layout of the baseboard drawn to scale, and it may be observed here that this should be followed carefully. No attempt should be made to reduce the amount of space taken up by the components on the high-frequency side, as this will lead to crowding and trouble will inevitably follow.

Adhere to the Layout

Further, apart from the question of the functioning of the set, another question which has received due consideration is the spacing and accessibility of the various leads, and it will be seen from the wiring diagram that all leads are well spaced, while the more important of these, such as those going to anode and grid, have been kept as short as possible.

Before commencing to wire up, it would be as well to mark out the positions on the baseboard where the twin coils and low-frequency transformer will come, in order that the leads put in before these components are placed in position will amply clear these units. The panel may now be fixed to the baseboard.

Wiring-up

The first leads to be put in are those connecting the low-tension battery to the valve sockets, this part of the work including the wiring up of the fixed resistance sockets and the L.T. switch. Any further connections which can be made at this stage are now completed, after which the first twin coil L_1 L_2 is placed in position, and the leads from this to aerial and earth terminals, the tuning condenser C_1, the neutralising condenser and H.F. choke are completed. The second grid coil is now placed in position, and the various leads from this taken to the points as shown in the wiring diagram.

Now fix the low-frequency transformer to the baseboard, and finish off the wiring of the receiver. It should be noted that a number of the connections can be made without out the use of a soldering iron.

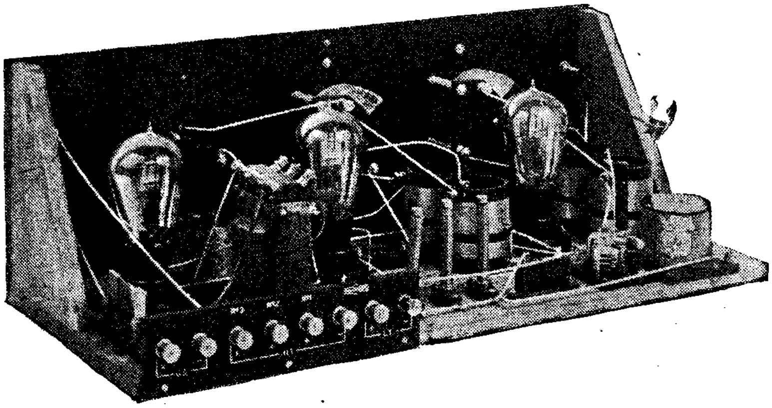
Filament Resistance Values

The values of the fixed resistors have now to be decided. Those used by the writer are of 4 ohms each, since this set is used chiefly with 5-volt ¼ amp small power valves, this being the correct value when using a 6-volt battery. If, however, it is desired to use ·06 valves with a 4-volt battery, the resistors will need to have a resistance of 17 ohms, while if it is intended to use a couple of ·06 valves for high-frequency and detector, and a 5-volt power valve for the low frequency, the two resistors for the high frequency and detector valves will be 50 ohms each, and for low-frequency 4 ohms, where a 6-volt battery is used.

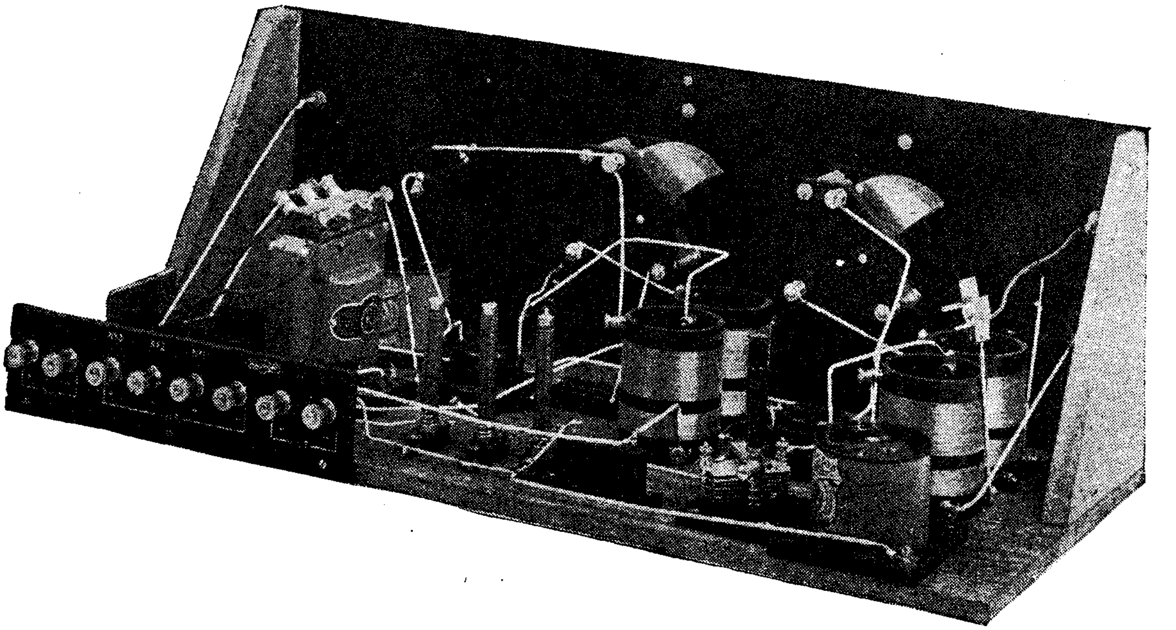
Care should be taken to ascertain that the values of the resistances are suitable for the valves and for the battery being used, otherwise the valves may be either over- or under-run, causing damage to the valve in the one case, and a reduction of efficiency in the other.

A Bench Test

Having completed the wiring, it should be carefully checked over, and a preliminary test may then be applied to see that the L.T. and H.T. circuits are correct. For this purpose place the valves in their respective sockets, and also the fixed resistors, connecting the L.T. battery to its terminals. Place the filament switch in the on position and see that the valves light correctly, then test each fixed resistor, and see that when it is unscrewed the valve goes out. Next strap the three high-tension positive terminals together, and connect the H.T. battery to the set, starting first with a small voltage of the order of 6 volts. With the valves turned on just touch the wander plug against the socket of the H. T.



The flex lead and spring clip on the aerial terminal are used to obtain the best aerial coil tapping for different wave-lengths.



The neutralising condenser (C_2 of Fig. 1) is that seen at the near end of the baseboard in this view.

battery and note whether the brilliance of the valves remains the same. If so, a higher voltage may be tried, and so progressively until the full working voltage is applied.

Aerial Reception

Everything being in order, the set may now be tested on the aerial, and the correct working voltages applied to the various valves. Where the 5-volt ·25 amp type of valve is being employed, a suitable H.T. value for the high-frequency valve will be in the neighbourhood of 60 volts. For the detector valve if of the D.E.5b type 100 volts may be used, and for the low-frequency 120 volts will be suitable. With ·06 valves a somewhat higher voltage is required on the high-frequency side, this being in the neighbourhood of 90 volts.

About 60 volts will be correct for the detector, or if this is of the D.E.3b type, a higher voltage in the neighbourhood of 100 volts will be found advisable. The low-frequency valve may have 100 or 120 volts applied according to the maker's rating. A suitable value of grid bias for the L.F. valve to start off with will be about 6 volts, and this may be adjusted accurately when actually receiving.

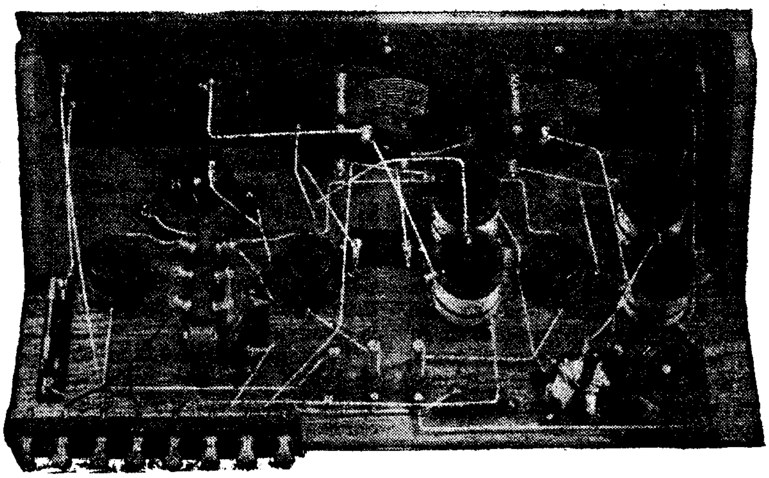
Telephones or Loud-speaker

It will be noticed that no provision has been made for switching out the low-frequency valve, but this may be included if required by the constructor. The local station may be received on a loud-speaker, and for other transmissions which are not strong enough to operate this instrument, telephones may be connected in its place.

For preliminary searching the neutralising condenser may be set at zero, and the local station tuned in. It will probably be found that the two dials on the tuning condensers do not read quite the same, the right-hand one being about 4 or 5 degrees less than the left hand one. The writer finds it convenient to set these dials so that both read approximately the same, this adjustment being quite satisfactory over the greater part of the range covered by the tuning condensers.

Adjusting Reaction

The high-frequency valve should now be turned out by means of the fixed resistor, and reaction increased by means of condenser C_5 until the point at which the detector goes into oscillation is found. The high-frequency valve is now switched on again, and the neutralising condenser adjusted until the set goes into oscillation at the same setting of the reaction condenser as before.



This photograph shows clearly the arrangement of the components and the wiring.

Transformer Ratios

Having tuned in the local station on the loud-speaker, the grid battery may now be adjusted, after which various transformer ratios can be tried to see which gives, not only the best amplification, but also the best quality. When using a valve of the type specially designed for resistance - capacity amplification for the detector (this being a high impedance valve) the best results obtained were found to be either with a 3 to 1 ratio or a 4·5 to 1 ratio, the connections employed being Po and P2, with So and S2, or P1 and P2, with So and S2; the second of these connections will probably be found suitable for use with a number of valves.

Distant Stations

These connections and adjustments having been satisfactorily completed, the telephones may now be connected to the output terminals on the set, and distant stations searched for. It will be found that the adjustment of the condenser C_3 is exceedingly critical for maximum signal strength (much more so than C_1), while for stations above 350 metres, the aerial should be connected to the first tap; and for stations above this wavelength, the second tap will be found best. Having tuned in one or two distant stations and acquired a little experience in handling this receiver, the effect may next be tried of altering the high-tension voltage applied to the high-frequency and detector valves, together with suitable adjustment of the variable grid leak for the detector. It will be found that the best results are obtainable at a certain value, and once found this may be left set.

Setting the Grid Leak

It should be noted, however, that the value of grid leak required for best results on the local station will not necessarily be the same for distant reception. It has been the writer's experience with distant reception that a higher value of grid leak will give better results, but if this is employed on strong signals such as those obtained from the local station, the purity of reproduction is not so good as that obtained with a lower value.

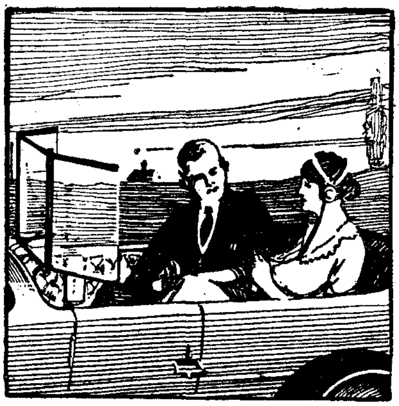
Valves Used

Various types of valves have been tried in this receiver, including bright emitters, and in no case has any difficulty been experienced in making the preliminary adjustments to the set, or in tuning in distant stations. The maximum output has been obtained with the 5-volt ·25 ampere power valve, but the results obtained with other types fell very little below those given by the former.

Elstree Test Report

The set was tested by the Elstree Laboratories, who stated that Nottingham, London, Manchester, Bournemouth, Rome, Newcastle and Birmingham were received on the loud-speaker. Various other relay and Continental stations were heard in the telephones. There was a slight trace of London when receiving Manchester, but on Bournemouth there was no trace of London at all. Cardiff could be received while London was working, but with some interference from the latter. The set was found to be simple to handle and its general ability extremely good.

HIGH-FREQUENCY AMPLIFICATION IN PORTABLE RECEIVERS



By J. H. REYNER, B.Sc. (Hons.), A.M.I.E.E.

Who describes how maximum volume may be obtained from few valves and a frame aerial.

PORTABLE receivers may be of two principal kinds. The more common kind is that in which provision is made for operating a small loud-speaker, which may or may not be built in to the make-up of the whole receiver, while the second kind is that in which telephones are employed. While the provision of loud-speaker signals is very desirable, the second type should not be neglected. For one thing, the telephone set is of necessity considerably more portable than one designed to operate a loud-speaker owing to the fact that transformers, extra valves, and extra battery capacity are required, while the expense of the loud-speaker article may exclude its use in certain cases.

High-Frequency Amplification Desirable

In either case, however, a stage of high-frequency amplification is desirable, and it will be interesting to discuss some of the methods whereby this may be achieved. Any portable receiver is usually operated either on a frame aerial or a small temporary aerial slung between a couple of trees or something of the kind. In the case where a frame aerial is employed, the necessity for high-frequency amplification is even more marked. Utilised on broadcast wavelengths a frame aerial of 2 ft. side having about 10 turns would, theoretically, give a signal strength less than that which could be obtained on a single vertical wire 1 ft. in height. It is obvious, therefore, since the height of the frame is greater than this, that the instrument itself must act to a considerable extent as an aerial, and as has previously been pointed out in these columns this accounts for a good deal of the lack of directional effect which often occurs with a frame aerial.

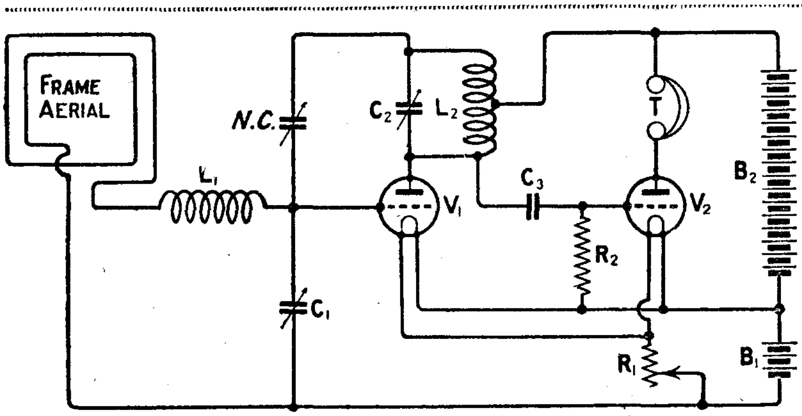


Fig. 1.—A straightforward but very satisfactory circuit employing a centre-tapped tuned anode arrangement. The neutralising condenser may be used to provide a reaction effect.

H.F. Preferable to L.F.

Even allowing, however, for the aerial effect, it is obvious that the total signals picked up must be 20 to 30 times as small as those picked up on the average 100 ft. aerial, so that the necessity for a certain amount of high-frequency amplification is immediately obvious. It is true that quite remarkable results can be obtained with a straightforward detector valve employing a smooth form of reaction control, but the signal strength on such an arrangement is usually too weak to afford any pleasure to the hearer. If therefore an extra valve is to be employed, then this is essentially a case where a high-frequency stage is of advantage.

In a portable set it is obviously desirable that the high-frequency amplification employed shall be as efficient as possible. The question is, therefore, how we may best obtain the efficiency which has been produced in some of the more recent receivers without the bulkiness which is usually a necessary accompaniment. Fortunately one stage of high-frequency amplification is fairly easily achieved.

Selectivity Not Essential

Selectivity is a consideration which does not seriously concern us, because the receiver is usually only intended to pick up the local station, and the efficiency, therefore, is the more important consideration. In such circumstances as these the tuned-anode arrangement is one of the best. It has the virtue of simplicity, and some recent tests which were carried out by myself indicated that the signal strength obtainable with a suitably

HIGH-FREQUENCY AMPLIFICATION IN PORTABLE RECEIVERS (*Contd.*)

arranged tuned-anode system was at least equal to the best obtainable with any other system, and was definitely superior to many other arrangements tried.

A Simple Circuit

The circuit shown in Fig. 1 is a satisfactory type of circuit. Here the frame is tuned to the incoming signal, a small loading coil being in circuit in series with the frame if necessary, while the anode circuit of the valve contains a split coil utilising the centre-tapped tuned anode arrangement. The high tension battery connection is taken to the centre point of the winding, and the remote end of the coil connected through a neutralising condenser back to the grid of the first valve. This arrangement may be employed to provide reaction by suitably over- or under-neutralising the high-frequency valve, and if the set is to be used on a small aerial or frame the risk of re-radiation will of course be practically negligible.

Using a Small Aerial

If the set is to be used on a small aerial instead of a frame, then the circuit becomes slightly modified, and the arrangement shown in Fig. 2 is so designed so that the set can be used either on a frame or a small aerial at will. The strap is connected across the frame terminals when the aerial is in use. For the anode coil, one of the various makes of centre-tapped plug-in coils may be employed, or the Dimic coil made by Messrs. McMichael will give very satisfactory results. In order that the circuit may be thoroughly under control, it is necessary to ensure that there is no appreciable magnetic coupling between the grid and anode circuits of the high-frequency valve.

To obtain this the coils may be placed at right angles to each other, and they should not be placed too far apart. This may seem peculiar, but as the coils are moved farther and farther apart the magnetic coupling falls off very rapidly but the capacity coupling between the circuits still remains, and it is quite possible for very peculiar results to be obtained.

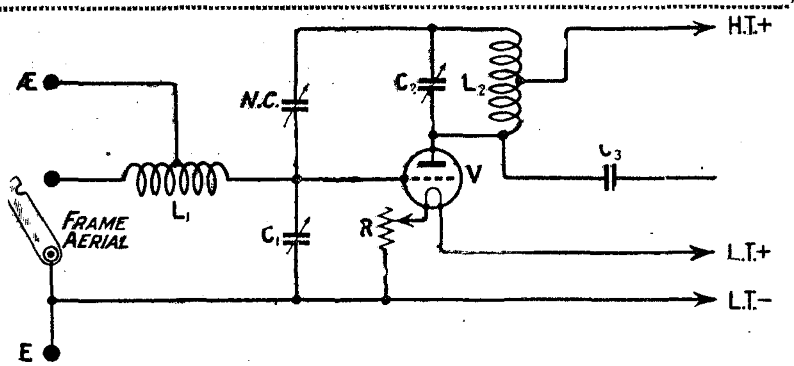


Fig. 2.—This modification of Fig. 1 enables a small aerial to be used instead of the frame when desired. The aerial lead is taken to the centre tap of L_1.

The Plug-in Transformer Method

Another type of circuit which may be employed is that employing an ordinary plug-in transformer having either a tuned primary or tuned secondary winding as desired. If strength is the first consideration, as it is in this case, the two windings should be tight coupled, and if this is done there is little to choose between the two arrangements. In order to neutralise this circuit, the grid winding of the receiver must be centre-tapped. This demands the use of either a centre-tapped frame, in which case no loading coil can be employed, as otherwise the symmetry will be destroyed, or alternatively the frame and the loading coil may be made approximately equal in inductance, and a centre tapping taken from a junction between the two. Neither of these methods, however, is as satisfactory as the split-anode arrangement, although they could be used with a little bit of experiment.

One Tuning Control Sometimes Advantageous

The disadvantage of the methods described so far has been that two tuned circuits have been necessary. It is sometimes desirable to employ only one control. In such a case one of the various makes of aperiodic high-frequency transformers may be employed. These transformers are so designed that they give a more or less uniform amplification over a band of frequencies, and can thus be used without the necessity for tuning either of the windings. Such arrangements, however, suffer from the disadvantage that the signal strength is by no means as great as that which can be obtained from a tuned stage of high-frequency amplification, and this drop in signal strength is the price paid for the simplification of control.

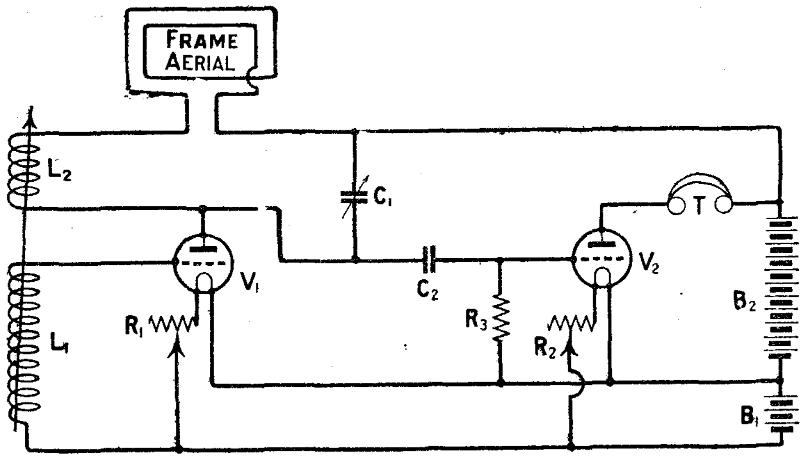


Fig. 3.—This form of circuit has the advantage that only one tuning condenser is required.

HIGH-FREQUENCY AMPLIFICATION IN PORTABLE RECEIVERS (Contd.)

An Anode-Input Circuit

The alternative is to use some form of anode-input circuit, and so to obtain only one tuned control in the anode circuit of the valve in question. A circuit employing an arrangement such as this is shown in Fig. 3. Here we have the frame aerial with a suitable loading coil in the anode circuit of the valve.

The coils L_1 and L_2 are variably coupled and may be ordinary plug-in coils of suitable size—say, 50 or 75. This coupling transfers the energy back to the grid circuit of the valve V_1 which causes fluctuations of the anode potential, and these in turn cause variations of the grid potential of V_2. By increasing the coupling between L_1 and L_2 continuous oscillations may be produced so that a reaction effect is obtainable by this means.

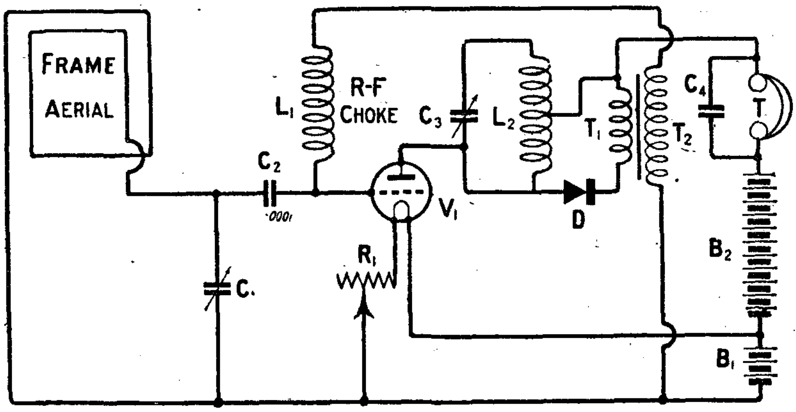


Fig. 4.—Excellent results can frequently be obtained with reflex circuits of a simple nature. The above circuit is a good type to try.

Reflexing

Reflexing is another device which may satisfactorily be employed in portable receivers, because many of the disadvantages which usually attend reflex circuits are either not important or can be endured in the case of a portable set because of the saving in valves. As has previously been stated, the principal object of a portable receiver is to obtain the maximum signal strength with the given number of valves. One simple type of reflex is that shown in Fig. 4. This is of the usual conventional type, the high-frequency and low-frequency components being separated out as far as possible. A crystal detector has been shown in this particular circuit, because the saving of a valve is a distinct advantage, and in such cases it will usually be found that the crystal damping is sufficient to prevent the circuit from oscillating uncontrollably, so that no neutralising arrangement has been shown in this case.

Since the centre-tapped coil has been employed in the anode circuit, however, there is no reason whatever why a neutralising adjustment should not be incorporated if it is found necessary. In such a case it would be connected from the remote end of the tuned anode coil back to the grid of the previous valve, and such a connection of course has the advantage that it may be utilised, probably in this case by over - neutralising, to produce the required reaction effect on the reflex valve, and so increase the signal strength in a convenient manner.

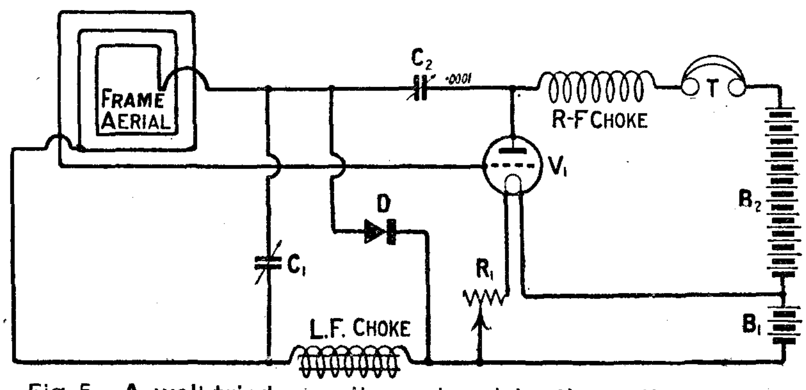


Fig. 5.—A well-tried circuit employed by the author, which has been found to give very satisfactory results.

A Well-tried Reflex Circuit

A further type of reflex circuit, which I employed some years ago and which has been giving satisfactory results ever since on a small single valve portable set, is that shown in Fig. 5. Here a species of anode-input circuit is employed, so that only one tuning control is obtained together with a form of Reinartz reaction (controlled by the ·0001 condenser C_2) while a crystal detector is employed for rectification. A choke is employed instead of a transformer. This arrangement gave satisfactory telephone signals, at distances of 20 miles from the local station, while of course the addition of one note magnifier would give signals strong enough to work a small loud-speaker.

Conclusion

The methods which have been given in this article are intended merely to indicate some of the methods which may be employed in order to obtain satisfactory amplification at high frequencies. On the whole the apparatus required for high-frequency amplification is lighter in weight than for low-frequency, and in addition the amplification before detection is definitely better in such cases as this where the initial input is extremely small. It will generally be found, therefore, that one stage of high-frequency amplification pays in a portable set, and the various circuits outlined in this brief article will give food for thought for those who are turning their attention at this time to the design of portable apparatus.

THE "ELSTREE SIX"
See Page 3

From my Notebook

by

H. J. BARTON-CHAPPLE,

Wh.Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

ON the 30th April during a lecture on "Modern Developments in Broadcast Reception" which I was privileged to give at a meeting arranged by the Bradford Radio Society, I had an opportunity of demonstrating The "Elstree Six," full constructional details of which appear elsewhere in this issue.

Although within 200 yards of the local station it was possible to cut out that station with a two degree movement of the four dials and receive distant transmissions, a fact which speaks volumes for the selectivity of the set.

Great interest was aroused by this demonstration of a Radio Press set in the north midlands before publication, and the questions asked and the information sought were indicative of the keenness and enthusiasm of the wireless amateur in that district.

❋ ❋ ❋

USING the call sign RAW, a new broadcasting station is carrying out transmissions at Tnapse, in Russia. The power is 4 kilowatts, and it is understood that the wavelength is 1200 metres.

❋ ❋ ❋

I RECENTLY had an opportunity of examining a piece of apparatus which provides an improved means for charging accumulators, provisional patents for which have been granted to Messrs. Pollock and Newby. Some test figures showed that whereas by the usual method the cost for current consumption in the case of three batteries (10, 50 and 80 ampere-hour continuous rating) was a certain figure, with this new method a saving of £22 10s. is effected (cost per unit taken as 3d.).

Each battery receives its correct charge at the proper rate, while the arrangement is quick and simple in operation and merits careful consideration by those interested in the problem of accumulator charging.

THE U.S.A. Government estimates place the number of wireless receivers now in American homes at above 5,000,000. That marks a notable increase since the past year, but 1926 seems sure to surpass even the remarkable record of 1925. Perhaps the two greatest fields for the development of radio this year, however, are its use on the farm and for educational purposes, and the special service to farmers is proving of far-reaching importance.

❋ ❋ ❋

THE studio of the new broadcasting station WJAZ is located on the twenty-third floor of the new Strauss Building, Chicago, and is the only one of its kind in the world. This station has abandoned completely the usual heavy draperies prevalent in most studios, and with the help of acoustic and electrical experts, WJAZ has overcome all obstacles of echo and has accomplished the one remaining necessity—local colour and atmosphere.

The studio proper gives the effect of a sunken garden surrounded by a massive wall while grilled openings, and large gateways overlook vast areas of country beyond, an illusion brought about by scenery. Automatically controlled lighting apparatus is placed scientifically to produce certain effects, with the hope that the flood-lights of various colours, fade-ins and fade-outs, sunrise, sunset and moonlight will inspire the artists to greater efforts.

The WJAZ station now being erected thirty miles outside Chicago will be operated by remote control from the studio in Chicago.

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WHEN looking for possible faults in a receiving set as the outcome of faulty signal reception, it is imperative to bear in mind that even the most unlikely places are worthy of examination. This fact was brought home to me very forcibly at a recent demonstration, as on tuning in the local station and switching over from telephones to a large Amplion loud-speaker the volume was reduced and the weak reproduction appeared "tinny." I spent a worrying half-hour examining all the connections, which by the way had weathered an adventurous motor and railway journey remarkably well, only two joints being defective. I obtained another similar loud-speaker and found the reproduction and volume of sound all that could be desired. Attention was immediately turned to the original loud-speaker, and the diaphragm mechanism was withdrawn from the horn for replacement.

Imagine my astonishment and feelings when it was discovered that the cork was still firmly in position in the hole leading to the horn opening, the loud-speaker having been delivered direct from stock. The remedy was obvious and the moral forcibly impressed on my mind.

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A CERTAIN amount of attention has been turned recently to an invention of an Austrian engineer named Emile Mark, who is stated to have devised a special process whereby secrecy is ensured for wireless communications. Of course, details of the invention have not yet been disclosed, but it is understood that the process involves variation of the transmitting station's wavelength at a very rapid speed, amounting to several thousand changes per second.

Any scheme which will enable wireless intercourse to take place secretly will be of far-reaching importance, and the results of developments on these lines are eagerly awaited by all interested in wireless in the slightest degree.

❋ ❋ ❋

THAT splendid body of men, the Royal Canadian Mounted Police, who patrol the great open spaces of the far North-West, and even the Arctic areas further north, has again been brought before the public eye through the recent announcement that the Canadian Government is equipping outlying stations with wireless receiving apparatus.

The receiving sets vary in type, seven-valve super-heterodyne sets being installed at some of the larger outposts, but the majority are being fitted with three-valve sets.

There is perhaps no other calling which involves so much isolation from civilisation, and the installation of wireless will put these men in touch with the outside world.

❋ ❋ ❋

OUR cousins over the Herring Pond are making a somewhat extensive use of "barretters" in lieu of filament rheostats for controlling the current passed to the valves from the L.T. source. This device, which often takes the form of a small cartridge fitted into clips similar to the grid leak arrangements, is really of relatively simple construction.

It consists primarily of a piece of wire mounted inside a glass tube filled with hydrogen. The wire chosen for the purpose has a high temperature coefficient, *i.e.*, its resistance has a comparatively large variation with temperature. Thus small variations in current are accompanied by corresponding variations in resistance which tend to compensate for small variations in applied voltage, giving what may be termed a ballasting effect.

These barretters (or amperites) must thus be chosen according to the type of valve employed, and hence their application in this country is somewhat limited owing to the wide range of filament currents.

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Experiments in tele-photography have recently been conducted between London and New York. In the example seen above it is interesting to compare the original photograph (top) with the "photo-radiogram" as received in New York.

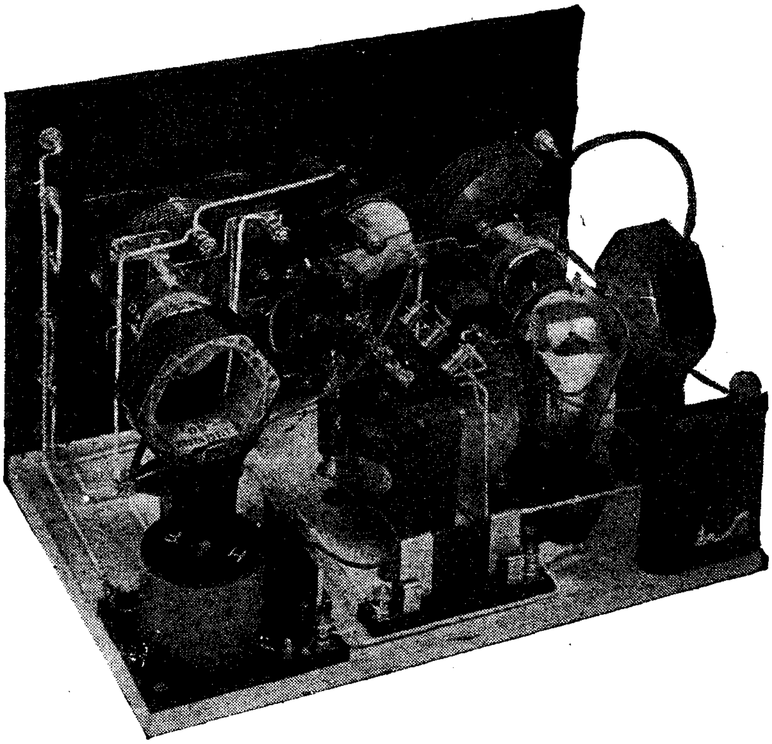
THE recent strike has demonstrated very forcibly that the position occupied by wireless amongst the amenities of mechanical and electrical civilisation is of extreme importance and leaves no shadow of doubt in the mind of the far-seeing individual that its future probabilities and possibilities are unbounded.

We shall, in a few years to come, be reaping the benefit of the scientist's investigations into the subject of television, and this will whet our appetites for a realisation of that time when electrical power is transmitted without any tangible medium.

That Irritating Hum

By John Underdown

In this contribution the author gives the results of successful experiments in the elimination of A.C. hum. Those who are troubled with interference of this nature will find the article of great interest.



The reflex receiver used was of the type employing a single valve and a crystal rectifier.

THE installation of alternating current electric lighting and power into the house often proves a somewhat mixed blessing to the keen broadcast listener. In some cases A.C. hum is picked up by induction to such an extent that signals are drowned, whilst in others the background is rendered noisy, marring any pleasure in DX work. Reflex receivers in particular are prone to behave in this manner, and in this article it is proposed to give an account of some experiments in eliminating these effects, which I have recently carried out.

A Serious Drawback

Where an outside aerial and earth system is employed the interference may be a negligible quantity, but if an inside aerial is used it is almost bound to run close to power or lighting wiring, thus picking up, by induction, an appreciable hum. To flat-dwellers who desire to utilise the house lighting system in place of an aerial it is often found that the hum is so pronounced in nature as to drown all signals completely.

This is a very serious drawback, as the large amount of electric wiring in blocks of flats often furnishes a more effective aerial than any other which can be erected. An arrangement which will allow this wiring to be used will therefore prove a boon to listeners so situated.

The Receiver Used

Since reflex receivers are often more prone to pick up hum from A.C. mains than are straight sets, I used a set of the former type during my experiments. The theoretical circuit is given in Fig. 1, from which it will be observed that the valve V_1 acts in a dual capacity, the rectified currents from the crystal detector circuit being fed back into the grid circuit of the valve by means of the L.F. transformer T_1 T_2, of which the secondary winding is in the aerial circuit. A number of refinements are present, such as neutralising the valve capacity, and separating the radio- and audio-frequency currents, but these do not materially affect the experiments and will not be discussed here.

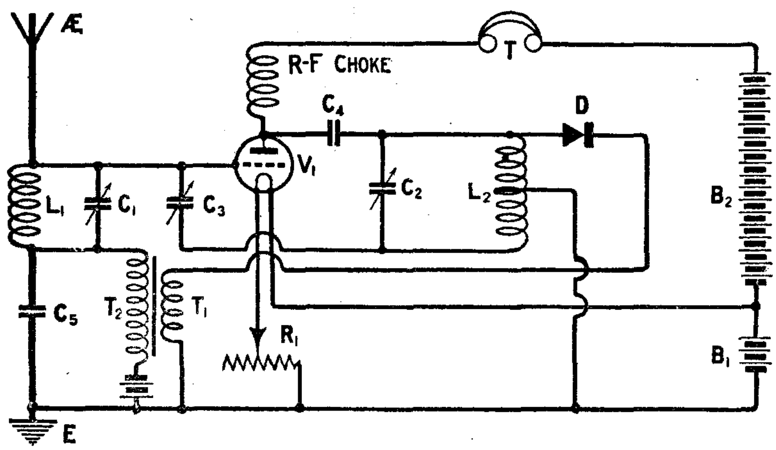


Fig. 1.—The theoretical circuit of the receiver used in the author's investigations on A.C. hum.

A "High-Pass" Filter

An obvious solution of the difficulty is to employ some filter arrangement which, whilst allowing the radio-frequency currents to enter the receiver, will effectively block the passage of currents at audio-frequency, under which latter category is placed the hum from the mains. The arrangement employed is a "high-pass" filter as indicated in Fig. 2. A number of condensers and inductances (or chokes) are connected as shown, and by suitably adjusting the values it can be arranged that the filter will cut out all frequencies below a certain value. This is due to the fact that the condensers, which are connected in series, are made of suitable capacity to allow the desired radio frequencies to pass through them, whilst to audio frequencies their impedance is very high.

The inductances, on the other hand, have a value such that they effectively prevent the higher frequencies from passing but act as a comparatively low impedance to audio frequencies. It follows therefore that if both audio- and radio-frequency voltages are applied across the input terminals then an almost pure radio-frequency voltage will be available across the output terminals.

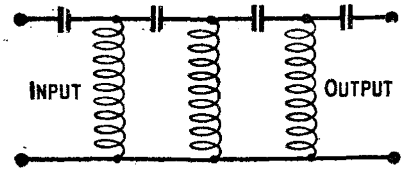


Fig. 2.—By suitably connecting a number of chokes and condensers it is possible to cut out frequencies below a certain value.

Simplifying the Arrangement

The arrangement indicated above is a somewhat complicated one, and would probably result in a considerable reduction in the strength of the desired transmission. A simpler system must therefore be found if it is to be of use to the listener.

Practical Experiments

As electric light is not installed in my own house the receiver was taken to a friend's house in a small village about 12 miles south-east of 2LO. This house is wired for electric light, the alternating supply being at 220 volts and the periodicity 50 cycles per sec. The set was tried first on a small outside aerial in conjunction with an ordinary buried earth. The hum from the mains was not very pronounced, being audible only during silent periods of the programme and then not to an extent to be particularly irritating unless one wished to search for weak transmissions. On telephones the signals from 2LO were too strong to be comfortable.

House Wiring as the Aerial

The next step taken was to obtain a really serious hum, and this was done very effectively by employing the house lighting wiring as an aerial. A defective electric lamp was secured and the glass smashed to expose the two lead-in wires. One of these wires was cut off short against the stem of the lamp, whilst the other was joined to one side of a ·005 fixed condenser. The free side of this condenser was joined to the aerial terminal of the receiver. The buried earth was retained throughout.

The hum obtained was at full loud-speaker strength and no trace of signals from 2LO could be heard, despite very careful searching and the employment of a slightly larger aerial coil to compensate for the fact that the wiring of the house was not extensive.

Adapting the Filter Arrangement

A simple adaptation of the high-pass filter arrangement indicated in Fig. 2 was then employed, the relevant part of the resulting circuit being as shown in Fig. 3. A fixed condenser of ·0001 was connected between the lead from the blocking condenser C_6, which permits the house wiring to be employed for the aerial, and the aerial terminal of the set, whilst across the aerial circuit of the receiver and the fixed condenser C_7 was placed a radio-frequency choke. C_7 was deliberately made ·0001, since in practice condensers of this value are often incorporated in various sets and the size is suitable to allow radio-frequency currents to pass through freely whilst offering a very high impedance to audio-frequency currents.

The aerial coil L_1 was, of course, increased in size to compensate for the insertion of the ·0001 condenser, a Gambrell B coil being employed. In the L_3 position a Gambrell J coil was first used, and with it the hum from the mains was reduced to about the same order as that originally obtained when using the outside aerial. With very careful tuning, signals from 2LO were obtained at good telephone strength.

Effect of Coil Sizes

Changing the J coil for a smaller coil, namely, an H, completely cut out the buzz from the mains, no noticeable difference in signal strength resulting.

A Better Arrangement

So far it was considered that the experiment was very successful, since from receiving a deafening hum and no signals, fair telephone signals, with a quiet background, had been obtained. In an endeavour to improve results, however, the arrangement shown dotted in Fig. 3 was tried, the aerial coil in the set being a centre-tapped B coil. With a J coil in the L_3 position it was found that the hum obtained was slightly less than with the original Fig. 3 arrangement and signal strength was slightly improved. On changing the J for an H coil really good telephone strength was secured, there being no trace of interference from the mains.

Since the coils in the receiver were only suitable for the lower broadcasting band of wavelengths, no experiments in receiving 5XX were made, but there would appear to be little reason why equal success should not be obtained on this wavelength, although certain readjustments of the sizes of L_3 and C_7 may be necessary.

Wiring for Loud-speakers

In conclusion, a few remarks on the subject of wiring the house for loud-speakers, where A.C. mains are present, may be of service. When long extension leads are to be run to distant rooms the routes by which the leads are taken should be determined only after very careful experiment, since serious interference from the mains may be experienced. The writer remembers a case in which the receiver was installed in the conservatory, and it was desired to listen at the other side of the house. Although reception in the conservatory was excellent, signals in the distant room were completely drowned by hum. Alternative "runs" for the leads were tried, but although the trouble was minimised to a certain extent, listening with any enjoyment was impossible. The difficulty was overcome finally by employing lead-covered twin flex, the outer metallic sheathing being earthed at convenient points.

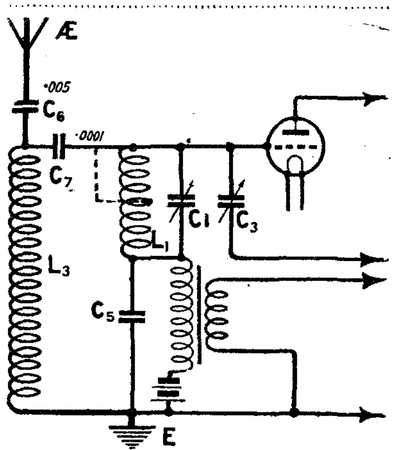
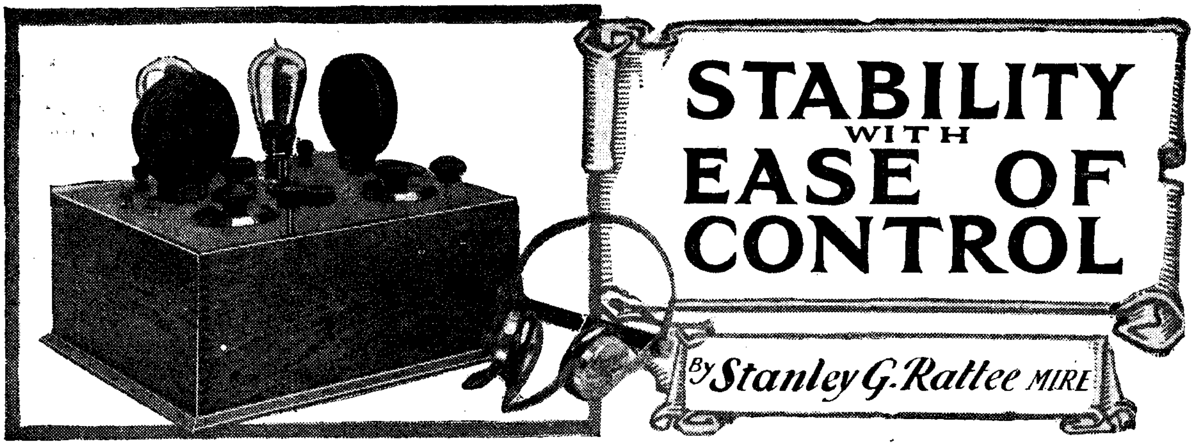


Fig. 3.—The arrangement adopted in adapting the "filter" to the existing reflex receiver. The dotted connection is an alternative for use with a centre-tapped coil.



STABILITY WITH EASE OF CONTROL

By Stanley G. Rattee MIRE

A useful and economical receiver is described here, which will be appreciated by those who like to choose their programme from stations at a moderate distance, and which will be found an efficient instrument for use during this period, when daylight prevails for the greater part of the evenings.

THE conditions with regard to reception at this time of the year may be said to be different from those prevailing during the winter months.

The difference may in fact have already been observed by listeners, in that distant stations which were formerly easy to receive are now either difficult to find or else the results obtained are relatively weak.

This effect will in most cases be more pronounced in sets employing, say, one valve which is used as the detector, than in sets of the multi-valve class, and the effect is largely due to the extension of the daylight hours, brought about by the time of year and the introduction of Summer Time.

Play for Safety

To make sure of receiving at this time of the year those stations which can be received upon a single valve reaction receiver during the long dark evenings of the winter months, it is a fairly safe conclusion to arrive at the fact that at least one stage of high-frequency amplification is necessary.

In my own particular locality, which admittedly is not good, yet is, nevertheless, one where there are others besides myself, it is possible during the winter to listen with comfort to Birmingham, yet now that same station is hardly audible upon the same type of set.

When the set employed incorporates a single stage of high-frequency amplification, however, reception of stations more distant than the local one becomes a more feasible proposition, while the demand for skill made upon the operator is less than is the case with the smaller set.

The Present Purpose

The object of the present set, therefore, was to enable the distant station of not too great a mileage to fall within the abilities of one's listening range, and, as may be gathered from the previous paragraphs, consists of a high-frequency valve followed by a detector valve with reaction.

Another point which should bear some consideration if it is desired to receive the distant stations is the fact that the more easy the reaction control, the simpler is the set to operate. Further, the simpler the set to operate without sacrificing sensitivity and selectivity, the greater the chance of "picking up" stations other than one's "local."

Reaction Control

The method of reaction control adopted in the present design is one which is becoming increasingly popular, and is given by means of a small condenser of the neutralising type, though its purpose of course is not to neutralise.

By increasing the value of the small condenser from its minimum the set may be made to oscillate over the full tuning range, and though the smallness of the condenser may at first give a false impression, in practice

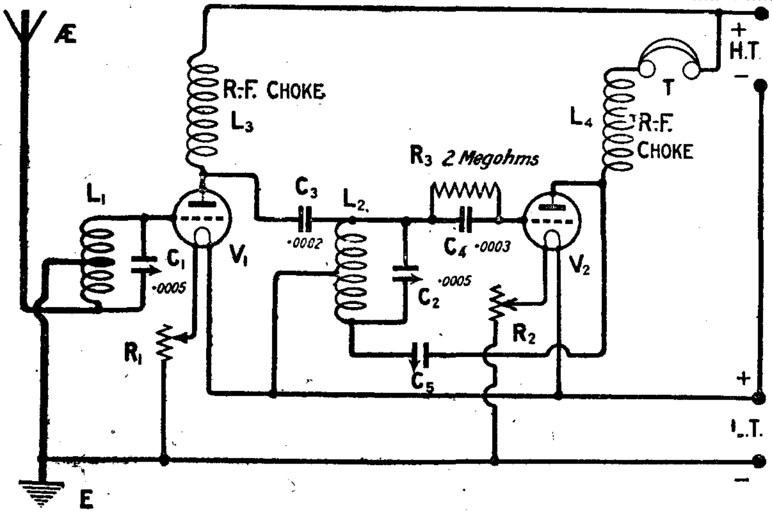


Fig. 1.—The condensers C_1 and C_2 form the main tuning controls, reaction being adjusted by means of C_5.

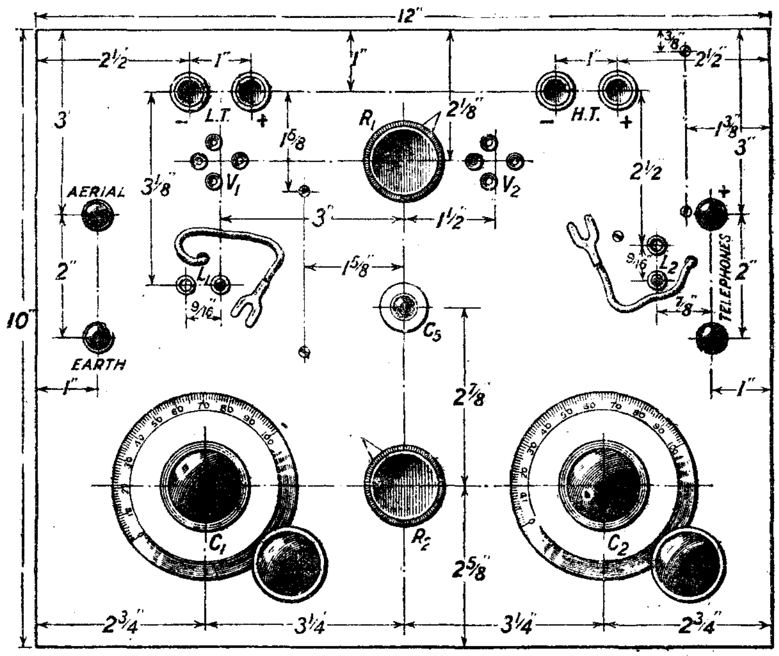


Fig. 2.—Close attention should be paid to the panel dimensions shown, if the exact components specified are used. The constructor may obtain Blueprint No. 162a free.

the control given leaves little to be desired.

A glance at the theoretical circuit diagram will show the position of the small condenser, whereupon it may be understood that its action is somewhat similar to the reaction condenser employed in the Reinartz circuit.

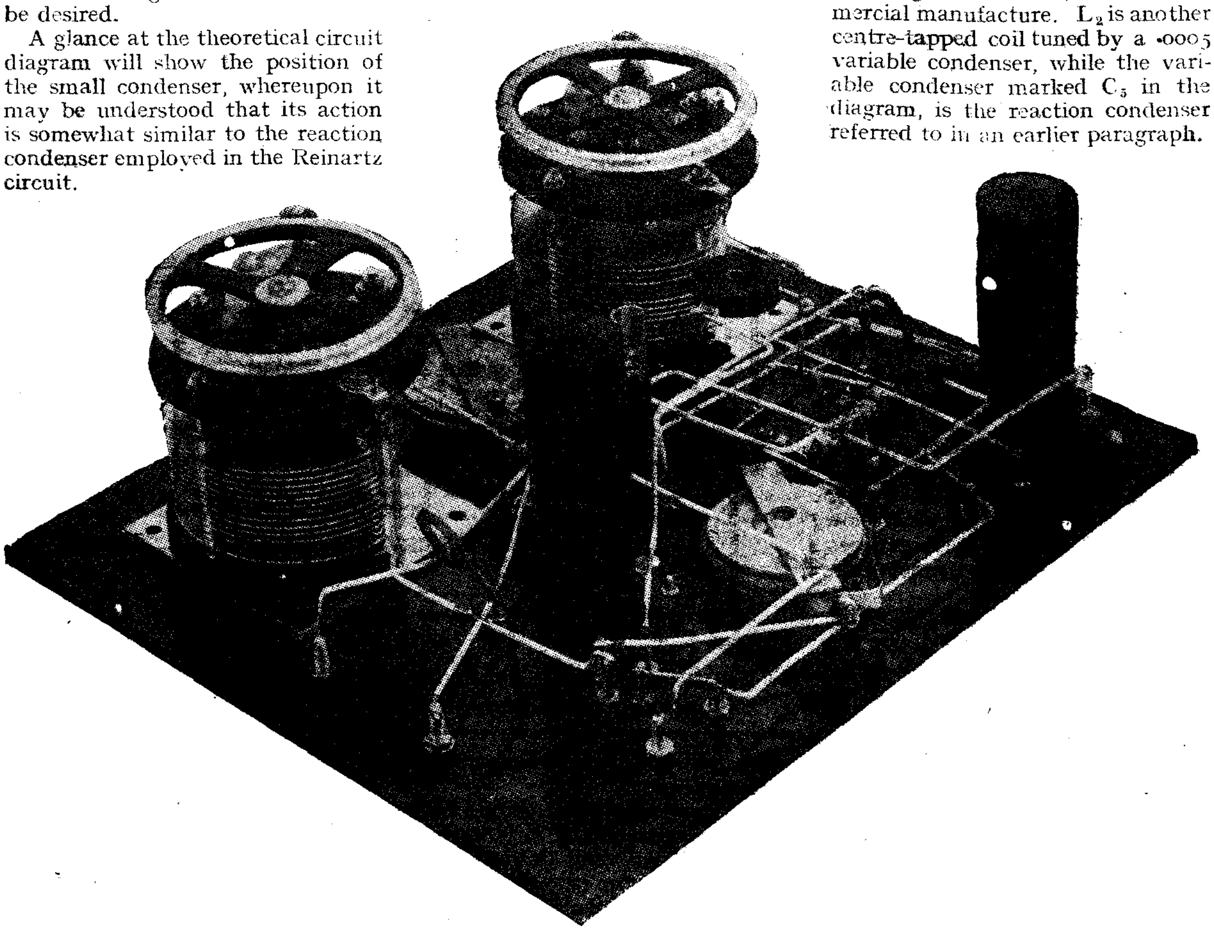
The Circuit of the Present Set

It will be understood that in order to obtain the best from any set utilising high-frequency amplification, it is necessary in the first place to make the receiver stable; that is, the circuit must be of such a type and the design must be so thought out that the high-frequency valve will not burst into self-oscillation when the set is tuned to the wavelength of the station it is desired to receive.

Further, since long distance is one of the main requirements of such a set, the question of selectivity must not be overlooked, and for this reason tapped plug-in coils are utilised in the present case.

As regards stability the point is easily satisfied by the present design, there being no tendency towards self-oscillation upon any of the broadcast wavelengths with any of the valves given in the paragraph devoted to the types of valves to use.

The coil L_1 is of the ordinary centre-tapped plug-in variety tuned by a ·0005 variable condenser. The coil L_3 is a high-frequency choke, L_4 being a similar coil, both of commercial manufacture. L_2 is another centre-tapped coil tuned by a ·0005 variable condenser, while the variable condenser marked C_5 in the diagram, is the reaction condenser referred to in an earlier paragraph.



Slow-motion condensers are utilised, in order to facilitate fine tuning. Note that, in wiring up, the connections nearest to the panel should be fixed first.

The condenser C_3 is one of the fixed type, having a capacity of ·0002, while C_4 and R_3 are the grid condenser and leak of ·0003 capacity and 2 megohms respectively, this latter value being found satisfactory for use with the valves stated in a later paragraph.

Components and the Values Required

For the guidance of intending builders whose practice it is to use the same makes of components utilised by the designer, the following list includes the names of the manufacturers or their trade marks, though it must be understood, of course, that other suitable makes may be chosen from those advertised in the advertisement pages of this journal.

Where values are given it is as well that builders be warned not to depart from the figures stated, for it is by such departures that unsatisfactory results are often obtained. In designing a set of this or any other type the question of value has, *inter alia*, received very thorough consideration both in the theoretical and practical stages of the design, and any departure in this respect may quite conceivably result in the finished set either not covering the desired wavelength range with a given set of coils or even proving unsatisfactory in other respects :—

One ebonite panel measuring 12 ins. by 10 ins. by ¼ in. (Trelleborg).

One cabinet, tray type, to take panel (Camco).

Two variable condensers each of ·0005 capacity, slow motion type (Radio Instruments, Ltd.).

Two coil sockets for panel mounting (Radio Instruments, Ltd.).

Two radio-frequency chokes (Lissen, Ltd.).

One "micrometer" condenser, "N type" (Radio Communication Co., Ltd.).

Two filament resistances, 6 ohms or of a value to suit the valves chosen (Igranic Electric Co., Ltd.).

One ·0002 fixed condenser (Watmel Wireless, Ltd.).

One grid condenser and leak, ·0003 and 2 megohms respectively (Dubilier Condenser Co., Ltd.).

Eight terminals marked "Aerial," "Earth," "H.T. +," "H.T. –," "L.T. + "L.T.–," "Phones +," "Phones –" (Belling & Lee, Ltd.).

Two valve holders for panel mounting, or alternatively eight valve legs for separate mounting direct upon the panel.

12 ins. of rubber covered flexible wire.

Quality No. 16 "Glazite" connecting wire.

Two U-shaped soldering tags.

The Panel

It will be noted from the photo-

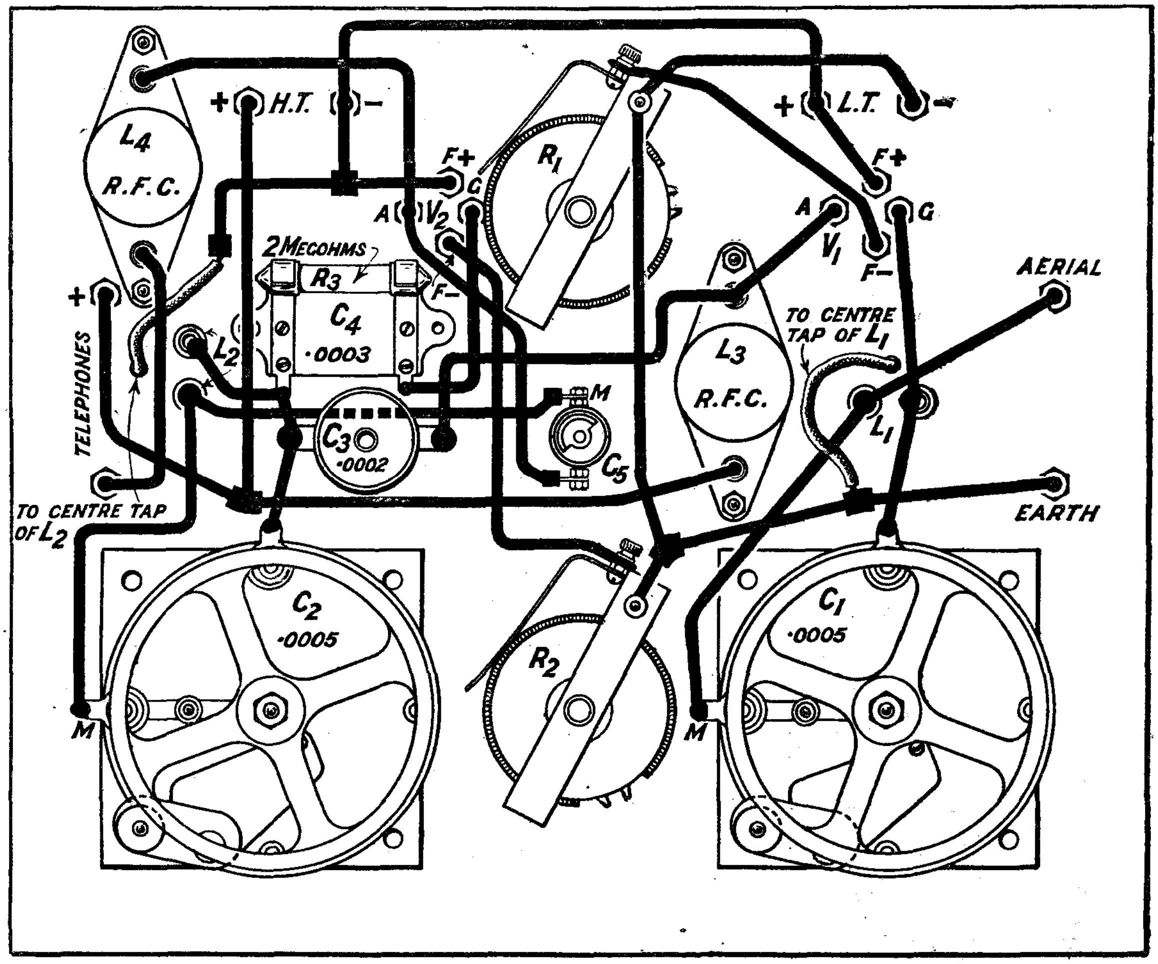
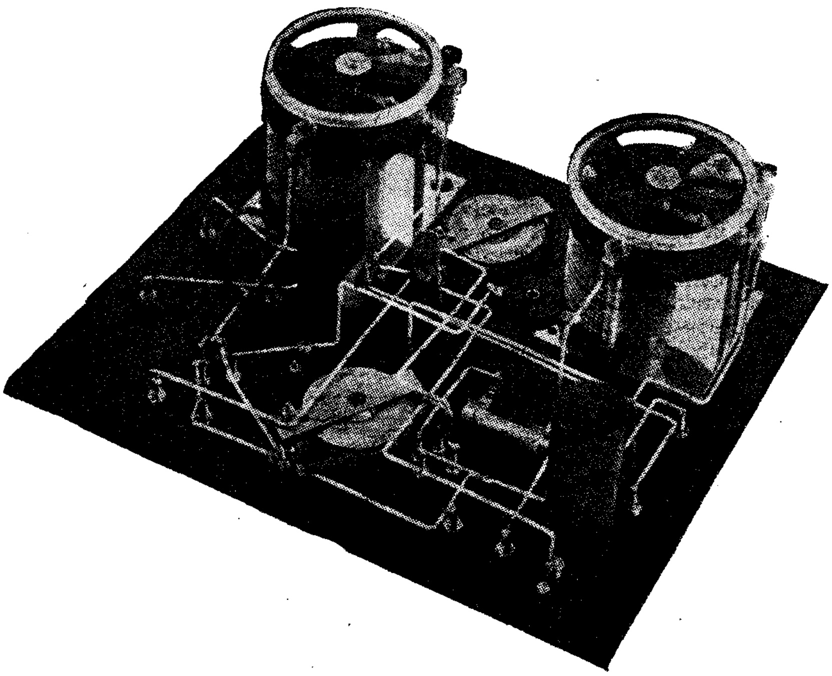


Fig. 3.—This diagram should be studied while the wiring is being carried out. Blueprint No. 162b is obtainable free.



The arrangement of the components should be carefully followed in order to allow ample clearance between them.

graphs that the arrangement of the present set is that of a horizontal panel, thus allowing all the components to be mounted thereon. The reason for adopting this type of panel is that for the circuit used the "flat-topped" set gives a simpler wiring proposition with easy accessibility to the centre-tapped coils and their tapping points.

When preparing the panel for drilling the dimensions given in the drawing illustrating the layout should be strictly adhered to. This instruction is, of course, somewhat governed by the makes of components chosen, but notwithstanding this fact the positions of the two coils L_1 and L_2 should not be altered in any way.

The positions given allow any make of suitable receiving valve to be inserted without fouling and at the same time permit either Lissen or Gambrell centre-tapped coils to be used.

The two variable condensers are conveniently situated along the front of the set, with the reaction condenser immediately behind and mid-way between these two, giving therefore plenty of freedom for operation. The terminals for the battery connections are placed along the back edge of the set so that the leads to these from the batteries are out of the way and practically out of sight. The flexible leads for making connection to the centre-tapped coils are brought through holes, drilled near to the actual sockets which hold these accessories.

Method of Wiring Up

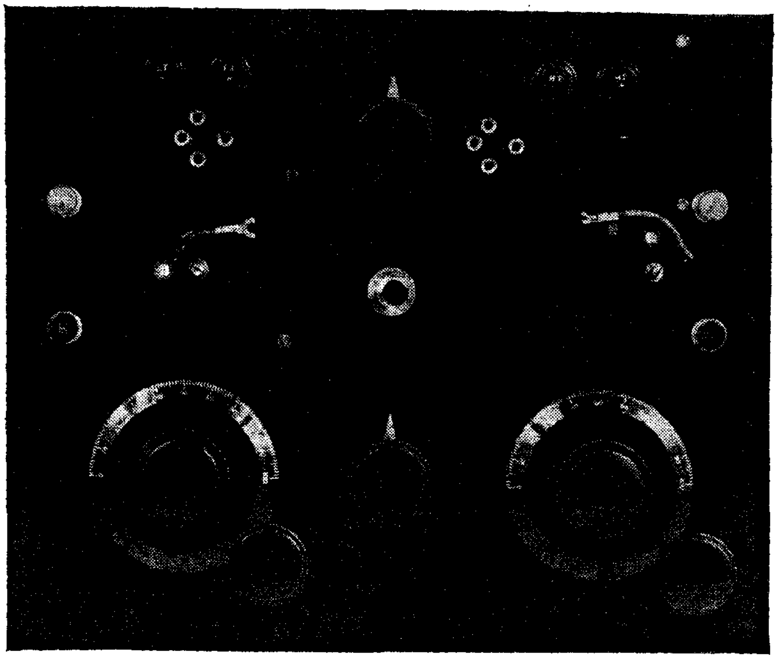
A careful examination of the photographs will indicate how the wiring is carried out, and these illustrations if examined in conjunction with the practical wiring diagram will aid greatly in simplifying the work to be undertaken.

It will be seen that certain of the wires are nearer to the panel than others, and these connections should be the first to receive the attention of the constructor. The connections which form the lighting circuit should, as an example, be the first to be soldered, followed by the grid circuit leads for both valves.

When connecting the variable condensers it should be remembered that in the case of C_1 the moving vanes are connected to the aerial terminal, while in the case of C_2 the moving vanes are connected to the reaction condenser, thus complying with the golden rule that the fixed vanes are connected to the grid of the valve in each individual case. In this particular instance the point is not of great importance, but since in most other receivers the point is an important one it is good practice to comply with the standard whether it applies to this present receiver or not.

Valves and H.T.

Experiment seems to indicate that a good general value for the H.T. voltage is 60 volts, this value being used with the following representative valves. The valves named may be taken as representative of types which may be used in either the H.F. or detector sockets:—D.E.5, D.E.5b., D.F.A.1



The tags on the flex leads are used for making connection to the centre tappings of the tuning coils. Note that these latter are placed mutually at right angles.

D.F.A.4, P.M.4, B.4, Cossor P2, general purpose valves and so on.

Increasing the high-tension voltage above the value just given does not affect the sensitivity of the receiver to any appreciable extent, therefore, for reasons of economy, 60 volts may be considered as being an ample value.

Testing the Set

After having fully satisfied oneself that the wiring is in accordance with the connections given in the practical wiring diagram, insert the valves and coils, making the flexible connections to these latter, and turn the filament resistances to the "off" position. With this done, connect a suitable L.T. voltage across the L.T. terminals, when by slowly turning the filament resistances the valves should light, their brilliancy being governed by the positions of the arms of the rheostats.

The accumulator should now be removed from the L.T. terminals and, as a test of the H.T. circuit wiring, should be connected to the H.T. terminals, whereupon the valves should *not* light irrespective of the positions of the arms of the rheostats.

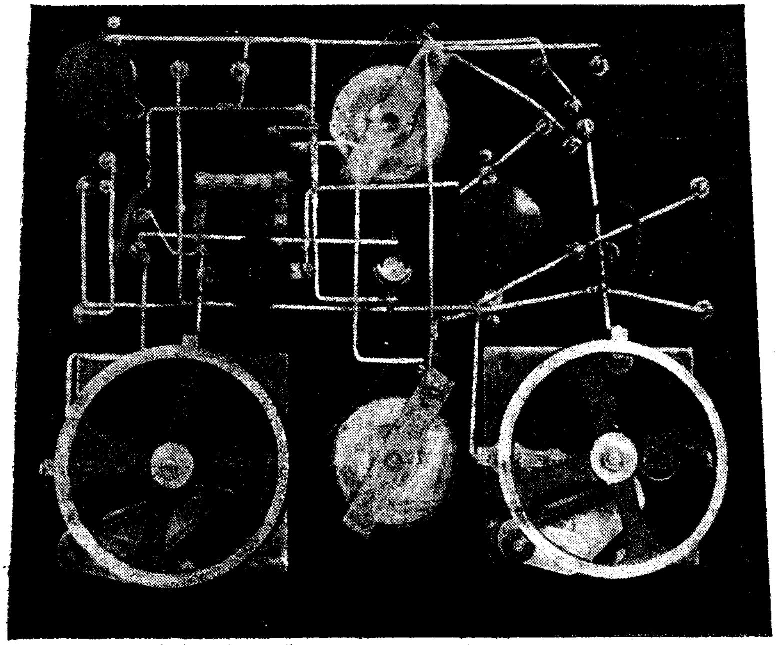
Upon this point being found to be satisfactory connect the accumulator again to its proper terminals, and connect the aerial, earth, H.T. and telephones.

Coils to Use

For the reception of stations using wave-lengths within the broadcast band L_1 and L_2 should each be a No. 60 centre-tapped coil or else a Gambrell C centre-tapped coil. For the reception of 5XX or Radio-Paris then L_1 and L_2 should be two No. 250 centre-tapped coils, or if Gambrell coils are used they should be centre-tapped F coils. With correct coils inserted the reaction condenser should be set to its minimum setting before switching on the valves, whereupon the operation of tuning may be commenced without fear of causing interference to other listeners.

Operating the Receiver

With the valves lighted to a suitable degree of brilliance and two suitable coils inserted, with the flexible connections made to the centre taps, turn both condensers to their zero reading, when by increasing the reading of C_1 to 10 degrees and slowly increasing C_2 from 0 degrees to 10 degrees or more, a slight breathing sound will be heard in the telephones at one definite position. This slight sound is an indication that the two circuits L_1 C_1 and L_2 C_2 are in tune, and upon advancing C_1 a further 10 degrees and following up with a further adjustment of C_2 this sound will again be "picked up." Proceed in this way advancing C_1 10 degrees at a time and adjusting C_2 so that the two circuits are in tune, when it will be found that by moving C_1 and C_2 each at a definite relative speed, the two circuits L_1 C_1 and L_2 C_2 may be kept in tune throughout the whole tuning range.



Neat wiring will conduce to greater efficiency of the finished receiver.

Reaction Adjustments

If the coils in use during this test are as given, proceeding in this way will soon result in either the local station or Daventry being "picked up" (whichever station it is being determined by the sizes of coils which are being used). With this station tuned in to its loudest, slowly increase the value of the reaction condenser, whereupon an increase in signal strength will be observed, up to a point where signals become distorted. At this point the reaction condenser should be reduced until the distortion ceases, when the set may be said to be giving the loudest results from the local station.

Broadly speaking this constitutes the method to be adopted with regard to tuning and handling the set generally, and upon keeping the two condensers turning at their correct relative speeds a number of distant stations will quickly be tuned in, when their strength may be increased by a slight increase in the value of the reaction condenser.

It should be borne in mind that the value of the reaction condenser should always be reduced if at any time during operation it is intended to reduce the readings of C_1 and C_2, as should we be working with these condensers at, say 60 degrees and 62 degrees for example, with the reaction condenser set to a maximum safe value, and then reduce the readings of C_1 and C_2 to, say 40 degrees and 42 degrees respectively, it is not at all improbable that the set will oscillate until the reaction condenser is also reduced in its value.

Some further details as to operation and the results obtained with this receiver will be given later.

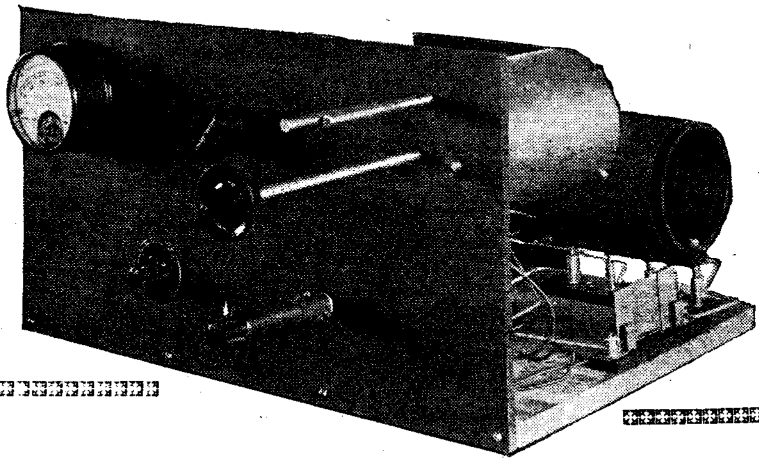
Elstree Test Report

The set was tested at the Elstree Laboratories, who stated that the receiver was easy to handle and that the reaction control was very smooth. On test the stations heard included Newcastle, London, Bournemouth, Glasgow, Radio-Toulouse, and Ecole Superieure.

We published in our April issue the description of a set entitled the "Compactum Two-Valve Receiver." We have now been informed by Messrs. The Ediswan Electrical Co., Ltd., that the word "Compactum" is a trade mark registered and employed by them. We were not aware of this fact at the time of publication, and we take this opportunity of correcting any misapprehension that may have arisen.

The Importance of Coil Layout

by the Staff of the Radio Press Laboratories.



An important contribution to the theory of set design is made in this article, the efficiency of multi-valve receivers in particular depending in large measure on the correct placing of the coils.

To facilitate fine adjustments, long control rods were fitted to the oscillator used in these experiments, the instrument being enclosed when in use in a screening case.

A SHORT time ago, during some experiments which were being made with high-frequency amplifiers, considerable trouble was experienced due to unwanted coupling between various parts of the circuit. At that time ordinary straightforward coils were being used, so that the only way of eliminating the coupling was to place the coils at some special angle in order to obtain a zero position as far as was possible.

Minimum Coupling

Several methods have been devised for obtaining this zero coupling effect. Where only two coils are employed, the problem is comparatively simple, and little difficulty is experienced in finding a variety of positions in which the coupling between the two coils is zero, although, as will be seen later, the actual zero position does not always coincide with that expected.

When three coils are employed, however, the problem is more difficult. We have to find positions for the coils so that the coupling between the first and second and second and third is zero, and also such that the coupling between the first and third is substantially zero. A very common method of doing this is that originally suggested by Professor Hazeltine, and incorporated in many receivers employing high-frequency stages. This consisted in spacing the coils at a certain critical angle which was in the neighbourhood of 57 degrees.

It can be shown that as far as the magnetic coupling is concerned, any coils placed at an angle of approximately 57 degrees to any other coil, in the manner as indicated in Fig. 1, will be in the position of zero coupling, irrespective of the actual distance between the coils. Consequently, if this system is adopted, then not only is the coupling between the adjacent coils zero, but also between the first and third and any subsequent coils.

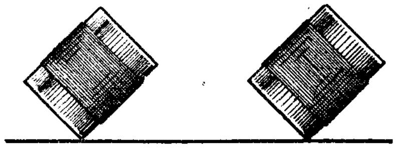


Fig. 1.—The Hazeltine method of obtaining zero coupling consists in placing the coils at a critical angle to each other.

A Practical Case

In the particular receiver under consideration, the several coils were placed approximately at the critical angle, and they had been so adjusted by trial that the coupling between the first and second and second and third coils was zero. The coupling between the first and third coils, however, was very marked, and further experiments showed that no matter in what position the first coil was placed, the coupling between the first and third coils could not be reduced to zero at all. The coil was turned round at all angles, was turned on end, and in general was placed in every conceivable position without succeeding in reducing the coupling below a certain fairly strong minimum.

Quite by accident the first coil was moved closer to the third coil, and it was found, somewhat surprisingly, that when this was done it was possible to obtain a position of zero coupling, but outside a certain critical distance no such position could be found, whatever the relative angles of the two coils in question. This obviously is a most important matter, and the question was therefore investigated on a definite scientific basis.

Investigating the Question

Two simple solenoidal coils, $2\frac{3}{4}$ in. in diameter and about $2\frac{1}{2}$ in. long, were employed for the test. One coil was fixed in position, and a small high-frequency voltage was introduced in series, from a local oscillator. The coil was tuned to the frequency of the incoming supply, which, it should be observed, was obtained from a totally screened oscillator to avoid any possible interaction from such source.

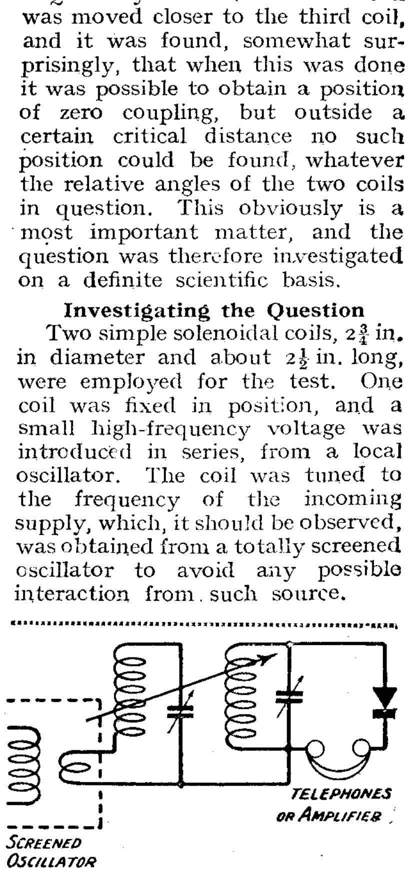
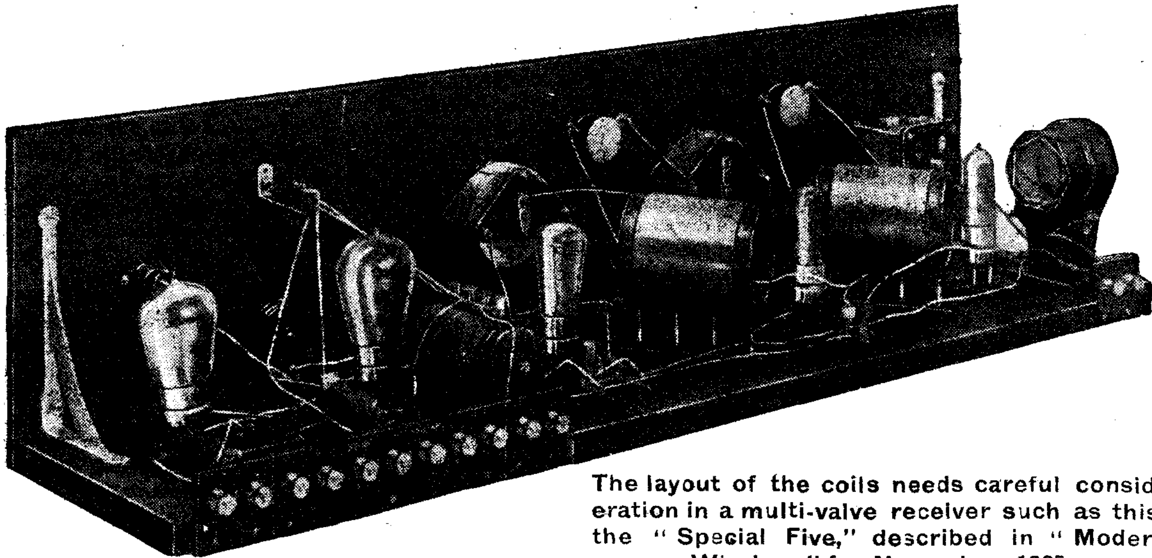


Fig. 2.—Details of the method adopted in the first experiments.

The second coil was likewise tuned to the same frequency as the first, and was provided with a crystal and a pair of telephones in order to detect the current. By placing the second coil in various positions relative to the first, it was possible to ascertain the positions of zero coupling, and so to



The layout of the coils needs careful consideration in a multi-valve receiver such as this, the "Special Five," described in "Modern Wireless" for November, 1925.

plot the curves giving the various zero coupling positions at different distances from the coil.

After the preliminary investigations it was found that the zero coupling positions became somewhat difficult to define at distances of 8 in. to 10 in. away from the first coil. This distance is by no means an excessive one, because in multi-valve receivers the third and first coils of the arrangement are often considerably further away than this, and it is with such coils that we are primarily concerned.

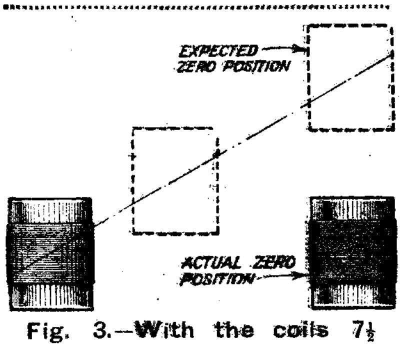


Fig. 3.—With the coils 7½ inches apart, the zero coupling position was that in which the coils were parallel.

Obtaining more Definite Results

In order to obtain more definite results, therefore, a small three-valve resistance-coupled amplifier was employed to amplify the telephone signals. The results which were obtained were extremely interesting, and furnished a ready explanation for the phenomena which had already been observed in the receiver.

When the coils were close together, zero coupling positions were obtained in the positions as shown in Fig. 3, in accordance with the usually accepted theory. One would expect, however, that as the distances were increased, so the zero positions would move upwards along the diagonal dotted line indicated. Actually it was found that the coils deviated considerably from this diagonal position, and the curve of the zero positions of the coil moved round until at a distance of 7½ in. between the coils the zero coupling position was obtained with the coils parallel.

The Critical Distance

This was the limit of the zero coupling position. At distances less than this the zero coupling positions lay on the dotted circle illustrated in Fig. 4. Outside this critical distance of 7½ in. no zero positions whatever could be found, thus completely bearing out the results which originally gave rise to the investigations.

The effect of reversing the second coil was then tried. Immediately, different results were obtained. As in the first case the positions of zero coupling when the coils were close together were somewhat as one would expect from theory. When all the various zero positions for different distances were plotted, however, a second circle was obtained similar to the first, except that in this case the circle was rotated through 90 degrees, as in Fig. 5. The limit of this circle was obtained with the coils end to end at a distance of 10¼ in.

A Point to Note

This, of course, is remarkable because one would expect at first sight to have a very strong coupling with the coils end on in a position like this. It is immediately obvious that we are not getting here simple straightforward coupling, because although the magnetic coupling between two coils falls off rapidly as the distance between them is increased, yet there is no point at

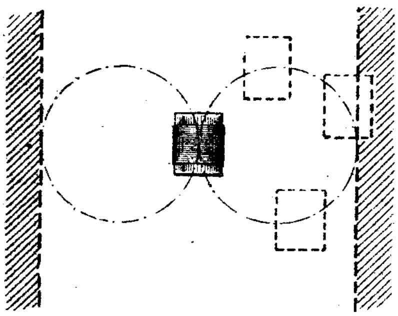


Fig. 4.—The zero positions lay on circles as shown, and outside a certain critical distance no position of zero coupling could be found.

which the coupling is reduced to zero, and beyond which the coupling increases again. Yet, as we have just seen, outside this critical distance of 10¼ in. the coupling increases again, and no position of zero coupling is found.

An Explanation

The only explanation of the phenomena, therefore, is that capacity coupling is being obtained between the two coils. Now this capacity coupling will of course fall off as the distance between the coils is increased, but it is conceivable that it does not fall off so rapidly as the magnetic coupling. Let us consider the original case. A zero coupling position was obtained here when the coils were

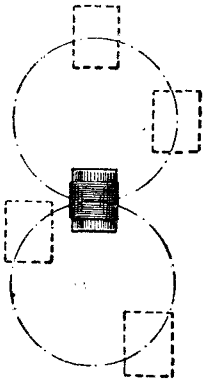


Fig. 5.—Reversing the direction of the second coil gave circles placed in this manner.

side by side at a distance of 7½ in. In this position the magnetic coupling was acting in one direction, and the capacity coupling acting in the opposite direction, and with the particular arrangement of coils they happened to cancel each other out at this particular distance. Inside the critical limit the magnetic coupling preponderated, while outside the capacity coupling preponderated.

It is obvious, therefore, that increasing the distance between the coils will not produce zero coupling, because there will always be a certain amount of capacity coupling left. The experiment indicates, of course, that this capacity coupling is very considerable in extent, because even when the coils were spaced 12 in. or 15 in. apart, there was still a large pick up between the two. As we have seen, this was due almost entirely to capacity coupling, since the magnetic coupling has been reduced almost to zero at a distance such as this.

If we reverse the direction of one of the coils, we reverse the magnetic coupling while leaving the capacity coupling the same. Obviously, therefore, the original zero position no longer holds, because in this case the magnetic and capacity couplings, formerly in the opposite direction, are now assisting each other, and strong signals will be obtained. One would expect, therefore, to obtain a zero position in the region where the coupling was previously the strongest, and reference to the original polar diagram, as we may call it, indicates that this would be when the coils were end on. This is exactly what was obtained, a zero position being found where the capacity and magnetic coupling cancelled each other out.

The Effect of Removing the Direct Connection

It will be noticed that in these previous experiments the two earthed ends of the coils were definitely connected together. This was done because in the majority of circuits employed in wireless receivers there is a definite connection existing, either direct or through the battery, between the earthed ends of the tuned circuit. As a matter of interest, however, the experiments were repeated with this direct connection removed.

Exactly similar results were obtained in this case, except that the diameters of the circles obtained were larger than in the previous case. A little thought will show that this result is to be expected. By removing the direct connection between the coils we have reduced to some extent the capacity coupling between them. The magnetic coupling, on the other hand, would not be influenced by this. Therefore, in order to obtain a balance between the magnetic coupling and the capacity coupling, we must find a position in which the magnetic coupling is weaker, and this is obtained by placing the coils further apart. The nature of the action therefore remains exactly the same, but the critical distance outside which no zero is possible is increased.

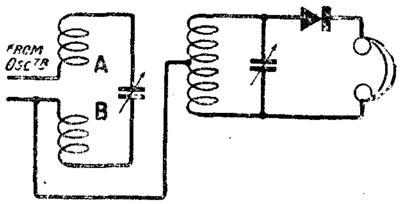
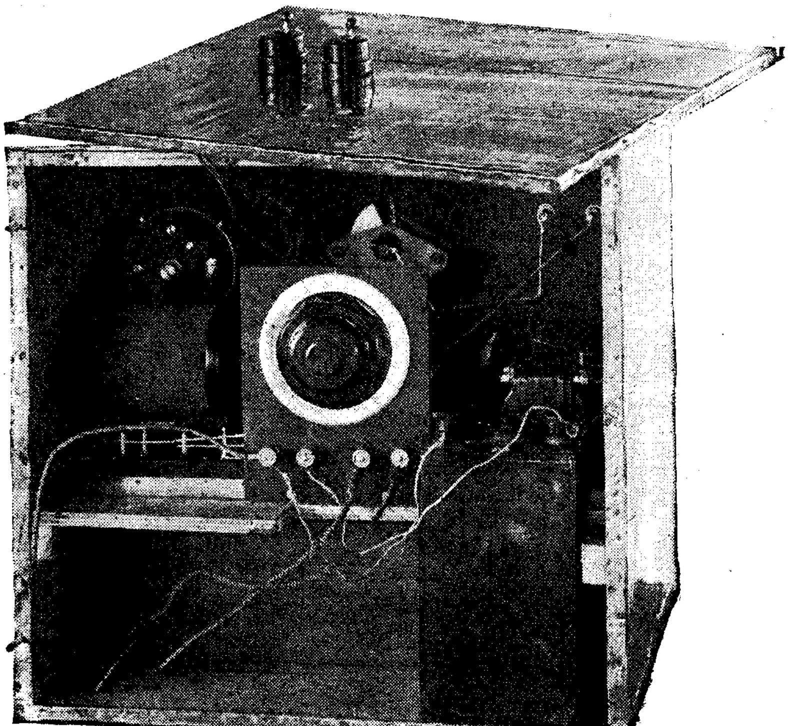


Fig. 6.—This circuit was used in an attempt to eliminate the capacity coupling between centre-tapped coils.

Minimum Coupling with Centre-tapped Coils

As centre-tapped coils are very commonly employed nowadays, the effect was tried of connecting the two centre points of the coils instead of the ends. This again produced exactly similar results, except that in this case the circles were very small, being about 4 in. and 5 in. in diameter respectively. The reason for this was immediately obvious, because the introduction of the E.M.F. had remained at the end of the first coil, so that we had really connected together two points at a high-frequency potential. This would increase the capacity coupling so that a zero position



A view of the oscillator with the back of the metal-lined screening case removed to show the interior.

would be obtained at points where the magnetic coupling was considerably stronger.

An Attempt to Overcome Capacity Coupling

To try to overcome this capacity coupling, the next experiment

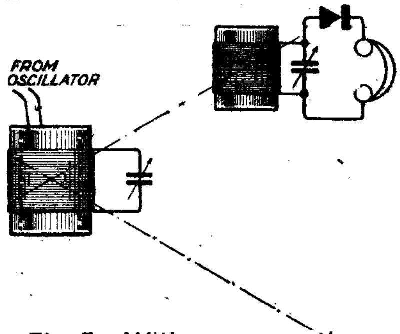


Fig. 7.—With no connection between the two coils, the the zero coupling positions were in accordance with the theory.

was to introduce the E.M.F. in the centre of the first coil. The circuit diagram was as shown in Fig. 6, and the mid-points of the coils were connected. It was found, however, even in this position, that there was sufficient capacity coupling due to the differences of potential between the two points A and B, to one of which, of course, the centre points had to be connected, and the asymmetrical results previously obtained were still repeated.

In order, therefore, to eliminate definitely the capacity coupling as far as possible, the energy from the oscillator was introduced by placing a small coupling coil inside the first coil. It was then found that as long as the coils were connected at any point, the results obtained were similar in every way to those which have previously been described. That is to say, positions were obtained for zero coupling which lay on figures of eight, the orientation of which depended upon the relative directions of the coils.

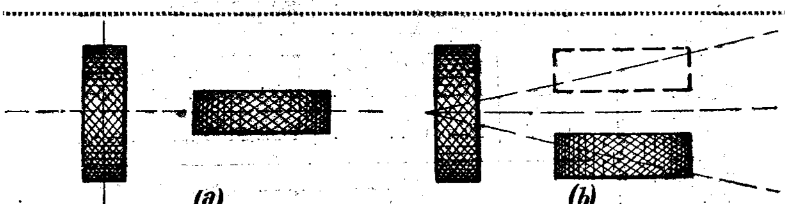


Fig. 8.—Even with two coils only placed as shown here, the actual zero position is not as at (a), but is displaced as at (b).

Omitting the Connection

In the case, however, where the connection between the coils was omitted, then the zero coupling position lay on straight lines passing through the centre of the first coil, exactly as one would expect from the theory. Reversing the coil did not alter the position of these lines in any way. This indicates definitely that the theory of critical angle only holds good as long as the coupling is purely magnetic coupling, and any capacity coupling destroys the symmetry of the arrangement at once.

Different Shapes of Coils

In order to obtain some idea of the effect with different shapes of coils, some of the experiments were repeated with a coil only one third the length of the previous coils. In all cases exactly similar results were obtained, the diameter of the critical circles being about 50 per cent. larger than in the corresponding cases for the longer coil. This is probably due to the relatively greater external magnetic field radiating from a short coil of this nature.

We have seen that this matter is of principal importance in cases where more than two coils are employed. To find a zero position between two coils only is a comparatively simple matter, but investigations showed that even in this case the actual positions of the zeros were displaced from the theoretical position.

A Simple Method

A simple way of obtaining zero coupling between two coils is to place them at right angles in the manner shown in Fig. 8 and Fig. 9. Actually the experiments showed that the zero positions were not on the centre line at all, but were slightly to one side or the other, according to the direction of winding of the second coil, due again to the capacity coupling.

If the connections of the second coil were changed, then the zero position lay on the other side of the centre line, and, as indicated in the figures, the actual zero positions lay on a more or less straight line at a small angle with the true axis of the coils. Thus the larger the distance between the coils, the greater the deviation from the theoretical position.

This fact was checked both for plug-in coils and for cylindrical coils, and the deviation in each case was similar in character, although somewhat more marked in the case of the cylindrical coils. Direct connections between the earthed ends of the coils aggravated the deviations.

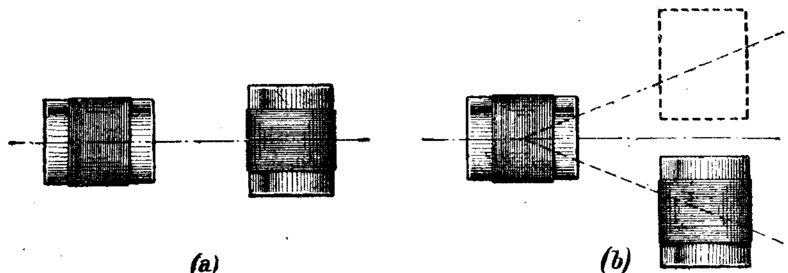


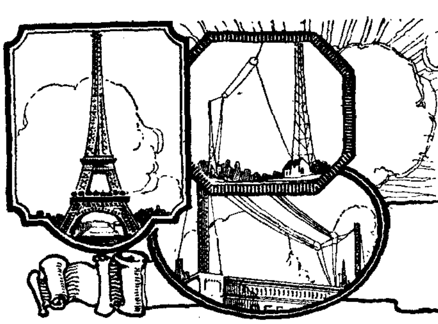
Fig. 9.—With cylindrical coils the deviation from the position shown at (a) is even more marked.

Careful Design Essential

The results described show how very important the layout of a receiver is, and they emphasise the need for following very closely the actual layout given in a particular receiver. The receivers described in this journal are the result of careful experiment, and the best position for the various components is found by the designer. While every effort is made to design receivers which are not too critical as regards layout, it will be appreciated that some types of circuits must necessarily be largely affected by the layout of the various parts, so that comparatively trifling deviations may cause considerable trouble.

Screened Coils

The experiments afford a very striking example of the utility of screened coils. By enclosing the coils in a metal screen, both the magnetic and the capacity couplings are reduced to a very small value, and the results which have been obtained with these components are very promising.



Regular Programmes from Continental Broadcast Stations

Edited by CAPTAIN L. F. PLUGGE, B.Sc., F.R.Ae.S., F.R.Met.S.

Time reduced to British Summer Time. *Corrected up to June 1st, 1926.*

WEEKDAYS.

B. S. T.	Name of Station.	Call Sign and Wavelength.	Closing Time or Approx. Duration.
a.m.			
7.30	Eiffel Tower	FL 2650 m.	10 mins.
8.56	Eiffel Tower	FL 2650 m.	5 mins. Sp.
9.40	Eiffel Tower	FL 75 m.	10 mins.
10.25	Eiffel Tower	FL 2650 m.	5 mins. Sp.
10.40	Radio-Paris	CFR 1750 m.	10 mins.
11.30	Eiffel Tower	FL 2650 m.	20 mins.
11.40	Hilversum	NSF 1050 m.	10 mins.
12.20	Eiffel Tower	FL 2650 m.	10 mins.
p.m.			
12.30	Radio-Paris	CFR 1750 m.	2 p.m.
12.57	Nauen	POZ 3100 m.	8 mins. Sp.
2.45	Eiffel Tower	FL 2650 m.	10 mins.
3.50	Eiffel Tower	FL 2650 m.	10 mins.
4.0	Zurich	—— 513 m.	6 p.m.
4.30	Milan	1MI 320 m.	6 p.m.
4.30	Radio-Paris	CFR 1750 m.	5 40 p.m.
5.0	Kiev	—— 780 m.	7 p.m.
5.0	Radio Castilla	EAJ4 340 m.	7 p.m.
5.15	Eiffel Tower	FL 2650 m.	10 mins.
6.0	Leningrad	—— 940 m.	9 p.m.
6.15	Frankfurt	—— 470 m.	8.15 p.m.
6.15	Stuttgart	—— 446 m.	7.30 p.m.
6.30	Union-Radio	EAJ7 373 m.	8.30 p.m.
6.30	Eiffel Tower	FL 2650 m.	7.55 p.m.
6.30	Moscow	—— 451 m.	8 p.m.
6.40	Brunn	—— 521 m.	9 p.m.
7.0	Hamburg	ha 392.5 m.	8 p.m.
7.0	Leipzig	—— 452 m.	8 p.m.
7.0	Radio-Barcelona	EAJ1 325 m.	8 p.m.
7.15	Oslo	—— 382 m.	8 p.m.
7.30	Stockholm	SASA 430 m.	11 to 12 p.m.
7.30	Munich	—— 488 m.	11 p.m.
8.0	Stuttgart	—— 446 m.	11 p.m.
8.0	Goteborg	SASB 286 m.	10.30 p.m.
8.0	Malmo	SASC 270 m.	10.30 p.m.
8.0	Sundsvall	SASD 545 m.	10.30 p.m.
8.0	Boden	SASE 1200 m.	10.30 p.m.
8.0	Oslo	—— 382 m.	10 or 12 p.m.
8.0	Hamburg	ha 392.5 m.	11 p.m.
8.0	Lausanne	HB2 850 m.	9.30 p.m.
8.0	Copenhagen	—— 347.5 m.	1 to 3 hrs.
8.0	Radio-Cadiz	EAJ3 357 m.	10 p.m.
8.0	Berne	—— 434 m.	11 p.m.
8.0	Radio-Wien	—— 531 m. and 582.5 m.	10.30 p.m.
8.0	Prague	—— 371.5 m.	10.30 p.m.
8.0	Radio-Paris	CFR 1750 m.	10 p.m.
8.0	Eiffel Tower	FL 2650 m.	10 mins.
8.0	Radio-Belge	SBR 486 m.	10.10 p.m.
8.0	Bratislava	—— 300 m.	10 p.m.
8.0	Hilversum	NSF 1050 m.	10.30 p.m.
8.5	Radio-Cadiz	EAJ3 357 m.	1 hour.
8.15	Konigsberg	—— 463 m.	10.15 p.m.
8.15	Kbely	—— 1150 m.	10 p.m.
8.15	Zurich	—— 513 m.	10 p.m.
8.15	Leipzig	—— 452 m.	2 to 3 hrs.
8.15	Frankfurt	—— 470 m.	11 or 12 p.m.
8.15	Breslau	—— 418 m.	10 p.m.
8.15	Geneva	—— 760 m.	10 p.m.
8.30	Lyons	PTT 480 m.	10 p.m.
8.30	Mont de Marsan	—— 390 m.	10 p.m.
8.30	Agen	—— 318 m.	9.30 p.m.
8.30	Konigswusterhausen	AFT 1300 m.	Midnight.
8.30	Voxhaus	b504 m. and 571 m.	Midnight.
8.30	Radio-Toulouse	—— 430 m.	11 p.m.
8.30	Ecole Sup. des Postes	FPTT 458 m.	11 p.m.
8.30	Munster	ms 410 m.	10.45 p.m.
8.30	Budapest	—— 560 m.	12 p.m.
8.40	Rome	1RO 425 m.	11 p.m.
8.45	Royal Dutch Meteorolog. Inst.	KNML 1100m.	5 mins.
8.55	Eiffel Tower	FL 2650 m.	5 mins.
9.0	Soro	—— 2400 m.	9.30 p.m.
9.0	Milan	1MI 320 m.	11 p.m.
9.0	Radio-Cartagena	EAJ16 335m.	11 p.m.
9.0	Marseilles	PTT 351 m.	2 to 3 hrs.
9.0	Radio-Béziers	—— 95 m.	1 hour.
9.10	Eiffel Tower	FL 2650 m.	11 p.m.
10.0	Radio-Barcelona	EAJ1 325 m.	2 to 3 hrs.
10.0	San-Sebastian	EAJ8 343 m.	11 p.m.
10.0	Radio Club Sevillano	EAJ5 357 m.	11.30 p.m.
10.0	Radio-Catalana	EAJ13 462 m.	1 a.m.
10.30	Radio-Iberica	EAJ6 392 m.	2 to 3 hrs.
10.30	Union-Radio	EAJ7 373 m.	1 a.m.
11.20	Eiffel Tower	FL 2650 m.	5 mins.
11.44	Eiffel Tower	FL 2650 m.	3 mins. Sp.
a.m.			
12.57	Nauen	POZ 3100 m.	8 mins. Sp.

SUNDAYS.

B. S. T.	Name of Station.	Call Sign and Wavelength.	Closing Time or Approx. Duration.
a.m.			
7.30	Eiffel Tower	FL 2650 m.	10 mins.
8.56	Eiffel Tower	FL 2650 m.	5 mins. Sp.
9.10	Hilversum	NSF 1050 m.	11.50 a.m.
10.25	Eiffel Tower	FL 2650 m.	5 mins. Sp.
11.30	Konigswusterhausen	AFT 1300 m.	12.30 p.m.
p.m.			
12.14	Eiffel Tower	FL 2650 m.	10 mins.
12.45	Radio-Paris	CFR 1750 m.	1.45 p.m.
12.57	Nauen	POZ 3100 m.	8 mins. Sp.
4.30	Milan	1MI 320 m.	6 p.m.
4.40	Bloemendaal	—— 315 m.	2 hrs.
5.0	Zurich	—— 513 m.	6.15 p.m.

SUNDAYS (Contd.).

B. S. T.	Name of Station.	Call Sign and Wavelength.	Closing Time or Approx. Duration.
5.30	Hilversum	NSF 1050 m.	7 p.m.
5.30	Rome	1RO 425 m.	6.30 p.m.
6.0	Leningrad	—— 940 m.	9 p.m.
6.0	Malmo	SASC 270 m.	8 p.m.
6 0	Warsaw	—— 380 m.	10 p.m.
6.30	Eiffel Tower	FL 2650 m.	7.55 p.m.
7 0	Radio-Iberica	EAJ6 392 m.	2 hrs.
7.0	Radio-Castilla	EAJ4 340 m.	9 p.m.
7.0	Brunn	—— 521 m.	9 p.m.
7.0	Hamburg	ha 392.5 m.	8 p.m.
7.0	Radio-Barcelona	EAJ1 325 m.	10 p.m.
7.0	Breslau	—— 418 m.	11 p.m.
7.0	Helsingfors	—— 318 m. and 522 m.	9.30 p.m.
7.30	Voxhaus	b 504 m. and 571 m.	Midnight.
7.30	Munich	—— 488 m.	10.30 p.m.
7.30	Konigsberg	—— 463 m.	10 p.m.
7.30	Bratislava	—— 300 m.	9.30 p.m.
7.30	Bilbao	EAJ9 415 m.	9.30 p.m.
7.30	Kbely	—— 1150 m.	9.30 p.m.
7.50	Hilversum	NSF 1050 m.	10.30 p.m.
8.0	Stockholm	SASA 430 m.	11 p.m.
8.0	Oslo	—— 382 m.	Midnight.
8.0	Berne	—— 434 m.	11 p.m.
8.0	Prague	—— 371.5 m.	10.30 p.m.
8.0	Copenhagen	—— 347.5 m.	10.30 p.m.
8.0	Radio-Wien	—— 531 m. and 582.5 m.	10.30 p.m.
8.0	Lausanne	HB2 850 m.	9.30 p.m.

B. S. T.	Name of Station.	Call Sign and Wavelength.	Closing Time or Approx. Duration.
8.0	Hamburg	ha 392.5 m.	11 p.m.
8.0	Stuttgart	—— 446 m.	11 p.m.
8.0	Radio-Cadiz	EAJ3 357 m.	1 a.m.
8.0	Budapest	—— 560 m.	Midnight.
8.0	Radio-Agen	—— 318 m.	15 mins.
8.0	Radio-Paris	CFR 1750 m.	10.45 p.m.
8.0	Eiffel Tower	FL 2650 m.	10 p.m.
8.15	Zurich	—— 513 m.	10 p.m.
8.15	Geneva	—— 760 m.	1 hour.
8.15	Leipzig	—— 452 m.	10 p.m.
8.15	Radio-Belge	SBR 486 m.	10.10 p.m.
8.30	Konigswusterhausen	AFT 1300 m.	Midnight.
8.30	Rome	1RO 425 m.	11 p.m.
8.30	Ecole Superieure	FPTT 458 m.	11 p.m.
8.30	Radio-Toulouse	—— 430 m.	11 p.m.
8.30	Frankfurt	—— 470 m.	10.30 p.m.
9.0	Milan	1MI 320 m.	11 p.m.
9.0	Soro	—— 2400 m. 1500 m. and 1150 m.	9.30 p.m.
9.0	Radio-Cartagena	EAJ16 335 m.	11 p.m.
9.0	Petit Parisien	—— 333 m.	10.30 p.m.
9.10	Eiffel Tower	FL 2650 m.	11 p.m.
10.0	Radio-Club-Sevillano	EAJ5 357 m.	12 p.m.
10.0	San-Sebastian	EAJ8 343 m.	12 p.m.
10.0	Radio-Catalana	EAJ13 462 m.	Midnight.
11.0	Union-Radio	EAJ7 373 m.	12.30 a.m.
11.44 a.m.	Eiffel Tower	FL 2650 m.	3 mins. Sp.
12.57	Nauen	POZ 3100 m.	8 mins. Sp.

SPECIAL DAYS.

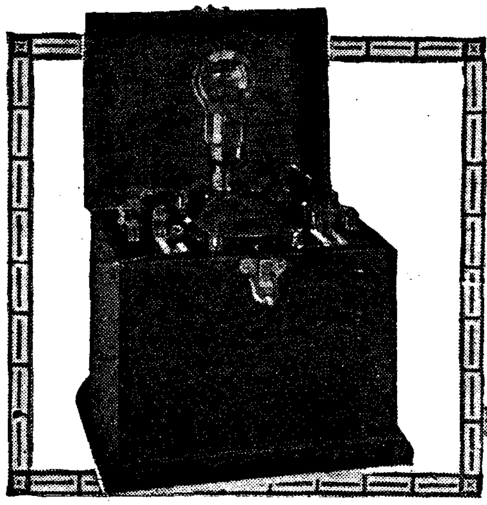
B. S. T.	Name of Station.	Call Sign and Wavelength.	Situation.	Nature of Transmission.	Closing Time or Approx. Duration.
p.m. 5.0	Radio-Belge	SBR 486 m.	Brussels	Tues., Thurs., and Sat., Concert, followed by News	6 p.m.
6.15	Rostow	—— 1000 m.	Russia	Weekdays, except Tuesday. Lectures	7.15 p.m.
7.0	Nijni Novgorod	—— 860 m.	Russia	Tues. and Thurs., Concert and Opera	11 p.m.
7.0	Sokolniki	—— 90 m.	Russia	Mons., Weds., and Fri., experimental Transmissions	8.30 p.m.
8.30	Ryvang	—— 1150 m.	Denmark	Tues., Wed., and Sat., Concert	10.30 p.m.
8.30	Le Matin	—— 1750 m.	Paris	Saturday, Special Gala Concert	11 p.m.
9.15	Petit-Parisien	—— 333 m.	Paris	Tues., Thurs. and Sat., Concert (Items announced in English as well as French)	11 p.m.
11.0	Oslo	—— 382 m.	Norway	Saturday, Dance Music from Hotel Bristol	Midnight.

The following are relay Stations :—

Cassel, 273.5 m., 1.5 kw., relays Frankfurt.
Elberfeld, 259 m., 1.5 kw., and Dortmund, 283 m., 1.5 kw., relay Munster.
Nuremberg, 340 m., 1.5 kw., relays Munich.
Gleiwitz, 251 m., 1.5 kw., relays Breslau.
Stettin, 241 m., 0.45 kw., relays Voxhaus.
Dresden, 294 m., 1.5 kw., relays Leipzig.
Bremen, 277 m., 1.5 kw., and Hanover, 296 m., 1.5 kw., and Kiel, 230 m., 1.5 kw.
Graz, 397 m., 0.5 kw., relays Radio-Wien Sun., Mon., Thurs., and Sat.
Hjorring, 12.50 m., 0.25 kw., and Odense, 810 m., 0.25 kw., relay Copenhagen ; sometimes Ryvang.
Lyons La Doua, 480 m., 0.5 kw., Marseilles, 351 m., and Toulouse, 310 m., relay Ecole Superieure, Paris.
Radio Zoologie, Antwerp, 265 m., 0.5 kw., relays Brussels.

The following Swedish Relay Stations are now working, using 200 watts :—
Gävle, 325 m. ; Umea, 215 m. ; Eskilstuna, 243 m. ; Saffle, 245 m. ; Kalmar, 253 m. ; Norrköping, 260 m. ; Jonköping, 265 m. ; Orebro, 237 m. ; Trollhattan, 322 m. ; Varbörg, 340 m. ; Karlstad, 221 m. ; Falun, 370 m. (400 watts) ; Linköping, 467 m. ; Karlsborg, 1350 m. ; Karlskrona, 195 m. ; Kristinehamn, 202 m.

These stations relay Stockholm as a rule, but also occasionally one of the other four main Swedish stations.



SOME USEFUL APPLICATIONS OF THE NEON LAMP

By H. J. BARTON-CHAPPLE, Wh.Sch., B.Sc.(Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

Last month a testing unit incorporating a Neon lamp was described. In this article the author indicates some further interesting uses of the Neon lamp, for which the same unit may be readily adapted.

It will be remembered that in last month's issue of this journal I gave full constructional details together with notes on operation for a testing unit which could be used for accurate measurements of resistances and capacities, both fixed and variable.

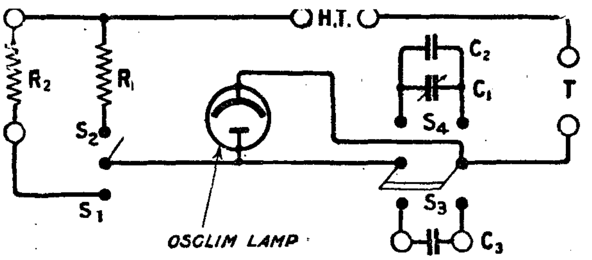


Fig. 1.—The circuit of the testing unit described last month by the present author is reproduced here for further reference.

A Useful Measuring Instrument

The prime object of this useful piece of apparatus is, of course, for determining the values of grid leaks and anode resistances and also the capacities of grid condensers, telephone condensers, together with the calibration of variable condensers. The Neon or Osglim lamp, however, with its peculiar properties, is a means to other ends, and in the hands of the experimenter will open up many interesting avenues of experiment.

A Simple Expedient

If when conducting the measurements previously described any discrepancies appear present they will nearly always be due to the lamp itself, and this can be overcome readily by a simple expedient. This consists in ageing the lamp before regular use by overrunning it for some time, *i.e.*, placing it across a voltage about double the rated value so that the electrodes become red hot.

Any impurities will then be driven off from them, and after treatment in this manner, and a rest for, say, a couple of days, the lamp will be found to exhibit a much greater steadiness. It thus becomes less liable to any progressive variations, and consistent and repeatable results are made possible.

Comparing Voltages

The unit as it stands will enable voltages of batteries to be compared within certain limits, these depending on the striking voltage of the lamp. For this purpose it is necessary to employ a grid leak in the position R_1 of Fig. 1 (which is reproduced from last month's article for the purpose of reference) whose value remains constant irrespective of the voltage applied across it.

Such grid leaks are now on the market, and it will be appreciated that this proviso is necessary otherwise erroneous results will be found due to resistance alteration, as a result of the relation existing between the periodicity of the flashes (T) the resistance (R) and the capacity (C), *i.e.*, T is proportional to the product of R and C.

Counting the Flashes

The values of R and C are preferably made large enough for the flashes to be counted, and with the switches in positions S_2 and S_4 the number of flashes per minute should be registered when a known voltage is applied across the H.T. terminals. Now place the unknown voltage across the H.T. terminals and again count the flashes, and the voltage can then be calculated easily by direct proportionality.

For example, if, say, the number of flashes is 60 per minute when the voltage is 200 and 54 per minute with the unknown source of pressure, then the required voltage is derived from the simple calculation :—

$$V = 200 \times \frac{54}{60} = 180 \text{ volts.}$$

Other Uses

I think it will now be interesting to mention a few other applications for the Neon lamp which on occasion may be used when conducting various experiments. Since the lamp possesses partial unilateral conductivity it can be utilised as a rectifier, although the incoming signals must be quite strong if sufficient audibility is to be apparent in the headphones.

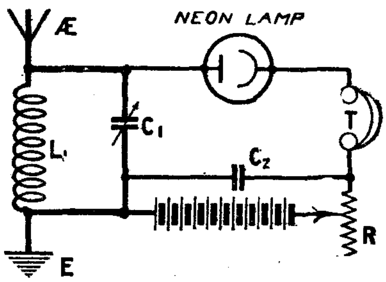
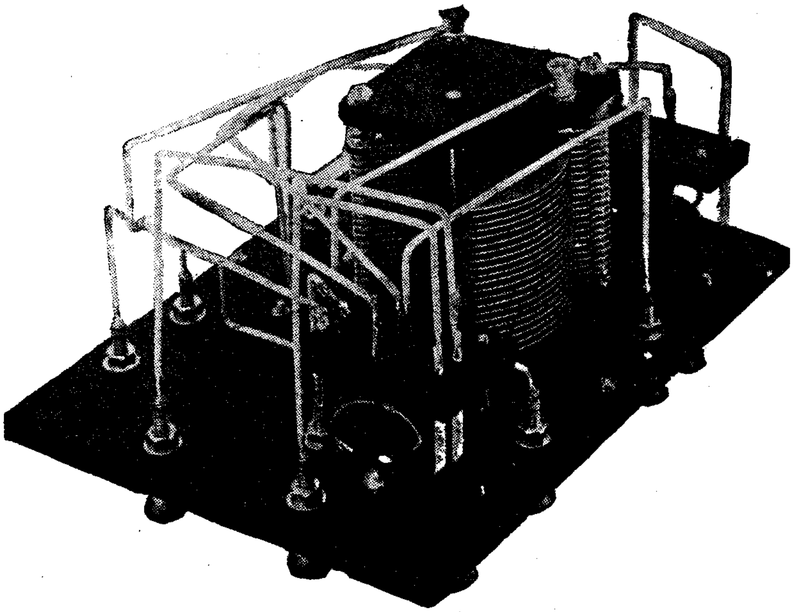


Fig. 2.—The Neon lamp may be used as a detector of wireless signals, using the above circuit.



To conduct some of the suggested experiments certain alterations to the back-of-panel wiring of the unit will be necessary.

Fig. 2 shows the circuit which may be adopted, R being a variable resistance of high value, while the H.T. applied should be of the order of 200 volts. The lamp should be made to glow feebly by a suitable adjustment of R and on tuning L_1C_1 to the local station signals become audible.

Obtaining Rectified H.T. Currents

Another successful application of the lamp is for the purpose of obtaining rectified H.T. currents from a spark coil. Fig. 3 gives the scheme of connections. The lamp is connected in the secondary (T_2) circuit of a high - voltage induction coil with a fairly rapid make and break, a condenser C_1

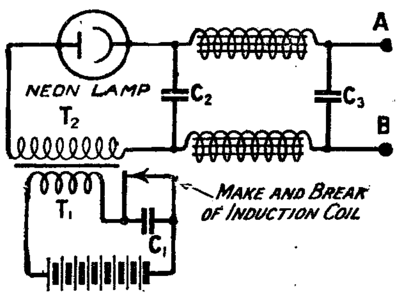


Fig. 3.—The connections for obtaining rectified H.T. currents from a spark coil.

being in position across the "trembler" contact.

If the voltage of the secondary is about 1000 volts the smoothing condensers C_2 and C_3 are preferably of the variety with good mica dielectrics to withstand the pressure. Two iron-cored chokes are also incorporated in the circuit as shown. The voltage at "make" on the induction coil is not large enough to drive a current through the lamp, but at "break" the high voltage surge passes through the lamp and the condensers C_2 and C_3 thus become charged and a fairly steady source of D.C. is available at the terminals AB.

Operation in Practice

In actual practice two or three lamps are used in series instead of the one shown in Fig. 3 owing to the high voltage developed by the induction coil at break, but if smaller voltages are required, then, of course, an induction coil of lower voltage must be employed and the number of lamps consequently reduced.

An Interesting Property

As mentioned last month, one of the most interesting properties of the Neon lamp is that of converting a direct current supply into a regular pulsating current. Now these pulses are not sinusoidal variations, but are really unidirectional surges and consequently a particularly large number of harmonics are present. Thus it is possible to select a particular harmonic by means of a tuned oscillatory circuit and hence generate practically undamped oscillations at a desired frequency.

A scheme of connections is suggested in Fig. 4 where the Neon lamp is fed from an H.T. source of about 240 volts through a variable high resistance, two high-frequency chokes and an inductance L_1. A ·001 variable condenser is shunted across the lamp and L_1, the values of L_1 and C_1 being adjusted so that they resonate at about the frequency desired. L_2C_2 are arranged to give a resonant frequency exactly the value desired, and then R_1 and C_1 are adjusted so that the lamp pulsates at its maximum frequency, and then a slight adjustment of either R_1 or C_1 will bring a harmonic into tune with the frequency fixed by L_2 C_2.

Shock Excitation

Of course L_1 C_1 is not an exact oscillatory circuit owing to the presence of the Neon lamp, but a system similar to shock excitation is introduced. The magnetic coupling between L_2 and L_1 may need a slight alteration, but should be kept as tight as possible, while the high-frequency chokes serve the purpose of keeping H.F. currents from the D.C. source.

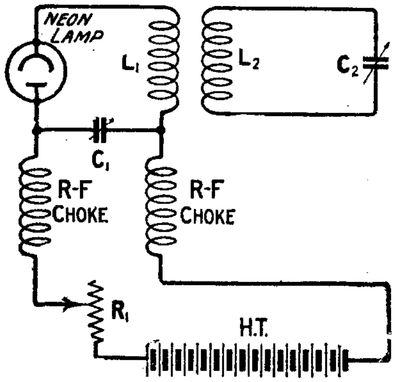


Fig. 4.—In conjunction with a Neon lamp a source of D.C. may be employed for producing practically undamped oscillations.

An Important Point

Since the fundamental frequency of the pulses of current is really a function of the supply current and the magnitude of the condenser C_1, as indicated in the previous article, the success of this system will depend in a large degree on the steadiness of the source of direct current. Every care must therefore be given to keep this constant if the arrangement is to work satisfactorily.

Most of the suggested experiments can be carried out with slight modifications to the testing unit, and much interesting information will be gained by readers through investigations carried out with the Neon lamp.

A group of Press representatives taken during the demonstration at Elstree on April 9.

The Development of Non-Radiating Receivers

Details of a demonstration given at Elstree to representatives of the Press.

As broadcasting develops, and its spheres of entertainment and usefulness expand, it is only natural that more and more people should purchase wireless receivers. Some have, perhaps, not already done so before because they did not consider the programmes of sufficient interest, but the inclusion of a new feature causes them suddenly to decide that it is time they had a set. Others, perhaps, have been without a set purely for financial reasons, until the sudden appearance of a set less expensive than the others places radio within their reach. Whatever the reasons, the cold fact is that the number of receivers in use is steadily and quite rapidly increasing; this is quite evident on taking a journey out of London by one of the suburban railways, and taking note of the number of aerials one sees.

Increasing Interference

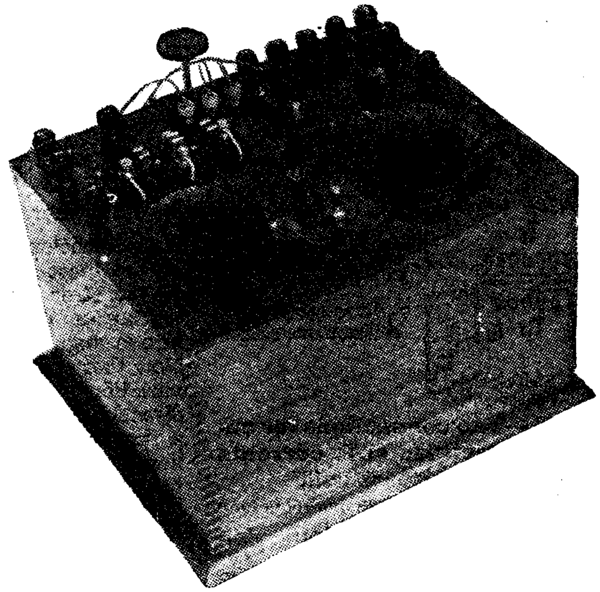
As quite a large number of the new receivers being installed are valve sets, it is obvious that the interference caused by unskilled handling will be steadily on the increase; it is unreasonable to suppose that all the valve sets newly acquired will be operated so carefully, at any rate for the first few weeks, as to cause no interference.

Non-Radiating Receivers

With these conditions prevailing, a receiver which cannot radiate or cause interference to neighbouring sets, however carelessly it is handled, will obviously be a great boon. It is therefore very appropriate that the Radio Press Research Staff should have chosen this time to develop the improved methods of reception which make it possible to have all the sensitivity obtained with one of the older types of set, and yet to make full use of reaction in such a manner that no interference can possibly be caused.

A Press Demonstration

On the evening of April 9th, a special demonstration of several of these non-radiating receivers was given at the Radio Press Research Laboratories before a large gathering of representatives of the Press and the B.B.C. In one of the Laboratory buildings a sensitive four-valve receiver was tuned-in to Birmingham. The signals from this set were relayed through a cable to the other building, about a hundred yards away, where they operated a loud-speaker. Another receiver employing one high-frequency valve and

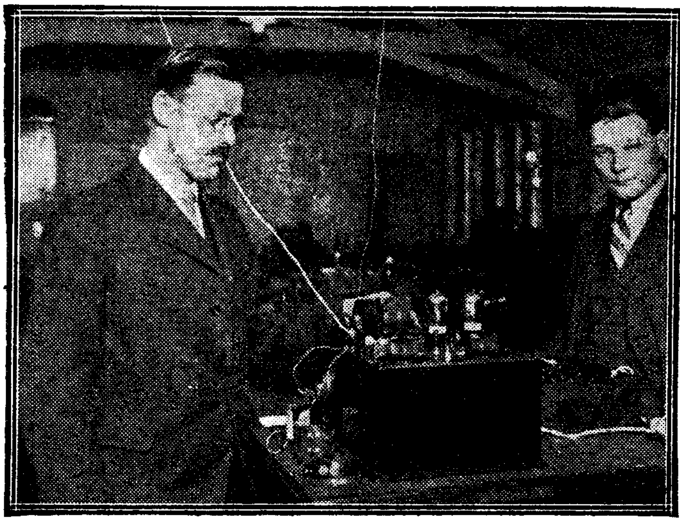


The "Huntsman Two," a non-radiating receiver described by Mr. Percy W. Harris in the March issue of the "Wireless Constructor."

a detector valve was then tuned-in to Birmingham in this building. reception, of course, being carried out on an aerial quite separate, but at the same time fairly close to, the other.

A Noteworthy Contrast

When this receiver was carelessly handled and caused to oscillate the familiar howls and whistles of tremendous strength were superimposed on the programme being received from Birmingham by the other receiver. Birmingham was then tuned-in on several of the non-radiating receivers, the number of valves employed ranging from two to six. In every case it was clearly apparent that however the specially designed receivers were mishandled, it was impossible to detect even a faint "squeal" in the loud-speaker connected with the four-valve set in the other building. The Press representatives were allowed to handle these receivers themselves, and, indeed, were invited to attempt to interfere with the reception of Birmingham by means of the receiver in the other building. Needless to say, none of them was successful in doing so.



In this photograph, Mr. Percy W. Harris (left) is seen operating the "Huntsman Two" non-radiating receiver. Even when the set was grossly mishandled there was no interference with a neighbouring receiver.

The Receivers Used

The receivers actually used in this demonstration were "The Huntsman Two," described by Mr. Percy W. Harris, M.I.R.E., in the March issue of the *Wireless Constructor;* "The Torostyle Two," described by the same designer in the May 1st issue of *Wireless;* "The Neutroflex Two," de-described by Mr. N. J. Gibson in the April 28th issue of *Wireless Weekly;* "The Neutrophase Four," described by Mr. J. H. Reyner, B.Sc. (Hons.), A.M.I.E.E., in the March issue of MODERN WIRELESS, and the "Elstree Six," described elsewhere in this issue.

The "Elstree Six"

The last-mentioned receiver, which, apart from its important non-radiating properties, is the last word in sensitivity and selectivity, was used for a special test at the conclusion of the "Non-Radiating Receiver" test mentioned above. The Press representatives present at the demonstration were invited to request the reception of any particular station that was known to be working at the time. Station after station was received with a wonderful degree of certainty and complete freedom from any of the distortion suggesting the excessive use of reaction. This receiver is capable of receiving any of the B.B.C. main stations, the Continental stations, and, best of all, all the B.B.C. *relay* stations in *broad daylight,* and at full loud-speaker strength. Full details for its construction and operation will be found in page 3 in this issue.

Press Opinions

One of the most concise of the actual newspaper reviews of the tests of April 9th, taken from the *Times,* is quoted herewith :—

The apparatus showed that, while it is possible to take full advantage of reaction, no amount of mishandling could produce that disturbing aerial oscillation known as "howling," which interferes so seriously with broadcast reception, and for which a remedy has now been found.

Among those present at the demonstration were: The Technical Editor of the *Daily Telegraph,* and special representatives from the *Times* the *Morning Post,* the *Daily Mail,* the *Daily News,* the *Daily Express,* the *Evening News,* the Press Association, and several provincial newspapers.

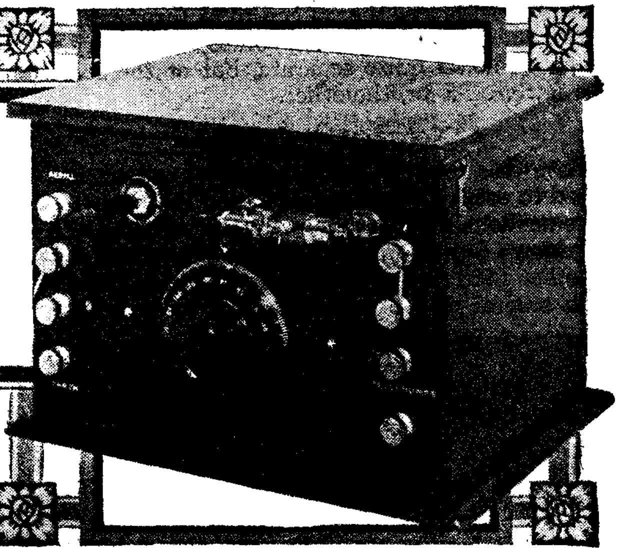
We are also authorised by the B.B.C. to state that they look with favour on any efforts towards the reduction or elimination of the possibility of interference from oscillating receivers, and are appreciative of the research work of this nature which is being carried out by our Laboratories.

DO NOT MISS THIS SPENDID OPPORTUNITY.

See Page 50 for details of the Editor's invitation for five hundred readers to visit the Elstree Laboratories and hear the "Elstree Six" for themselves.

You must Make this New Type of Crystal :: Set. ::

By W. S. PERCIVAL, B.Sc. (Hons.), A.R.C.S.



The advantages derived from the use of a tapped coil crystal receiver are made possible in this set by the incorporation of a vernier condenser.

An experimenter wishing to build a crystal set has the choice of two main types. On the one hand he may decide to build a set in which every effort has been made to obtain maximum signal strength. This often involves the employment of bulky tapped coils, thus increasing the size of the receiver and making the operation a trifle more difficult. On the other hand he may decide to sacrifice a certain amount of signal strength, and employ a set which has been designed to ensure both compactness and simplicity in operation.

In the present receiver a novel principle has been incorporated with a view to obtaining the advantages derivable from the employment of tapped coils without the necessity for departing from the use of the ordinary plug-in coils.

The Theoretical Circuit

The theoretical circuit diagram is shown in Fig. 1, the switches S_1 and S_2 being for the purpose of obtaining Daventry. When the local station is being received both these switches are left open.

The principle on which the circuit is based can be explained quite easily. The incoming high-frequency oscillations set up a certain small E.M.F. across the aerial coil L_1. These are not applied directly to the crystal and telephones, as there is a drop in high-frequency potential across the vernier condenser C_2. The advantage of this fact is that the load imposed by the crystal and telephones is partially removed from the aerial circuit. By rotating the knob of the vernier condenser this

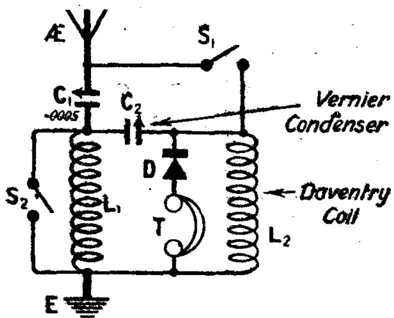


Fig. 1.—The circuit incorporates many novel features.

load can be adjusted, as in the case of a tapped coil. The lowest value of the vernier condenser corresponds to the lowest tapping on the aerial coil.

Arrangements for Daventry

When receiving the local station the coil L_2 serves as a choke, and also provides a continuous path for the low-frequency currents. When the Daventry station is required, switches S_1 and S_2 are both closed, the condenser C_1, which previously acted as a series tuning condenser, now serving the purpose of a parallel tuning condenser in this case. The circuit is redrawn in Fig. 2 in order to indicate in a clearer manner the arrangement for receiving Daventry. Although the circuits appear different, it will be seen on examination that they are really identical.

Operation

To obtain the local station, S_1 and S_2, which each consist of a strap connecting a pair of terminals, must be opened, the crystal adjusted and C_1 rotated until signals are heard. C_1 and C_2 are then adjusted until maximum signal strength is secured. Actually the adjustment of C_2 is not quite independent of that for C_1, and it is as well to retune when C_2 has been adjusted to its best position. In case severe interference is experienced, it may be advisable to decrease the value of C_2 below that required for the loudest reception of the station being received.

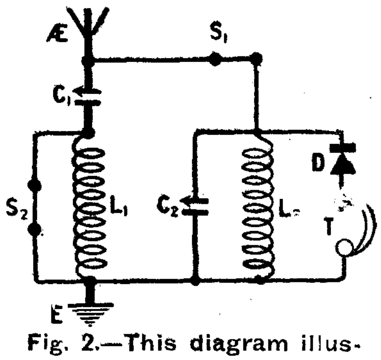


Fig. 2.—This diagram illustrates how C_2 is placed in parallel with C_1 for Daventry reception.

As mentioned above, for Daventry it is necessary to close both S_1 and S_2 and then tune in on the condenser C_1, which is now in parallel with the Daventry coil.

The Vernier Condenser

With regard to the adjustment of the vernier condenser C_2, it is generally sufficient to adjust this to its best position in a preliminary test and then leave it fixed. Tuning to Daventry need not affect the adjustment of this vernier condenser in any way, as it is simply in parallel with the large tuning condenser C_1, and only slightly increases the value of C_1. Although theoretically the vernier condenser could be adjusted for every crystal contact, the gain in signal strength by so doing is quite negligible, and in general can only be rendered evident by the use of a micro-ammeter.

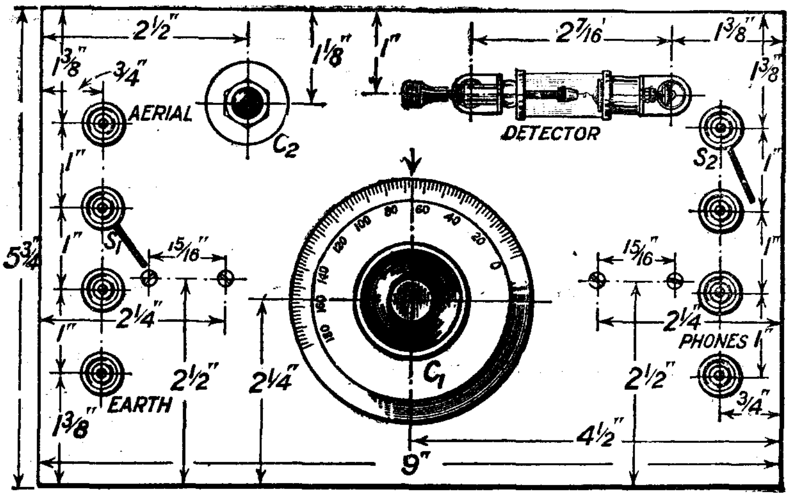
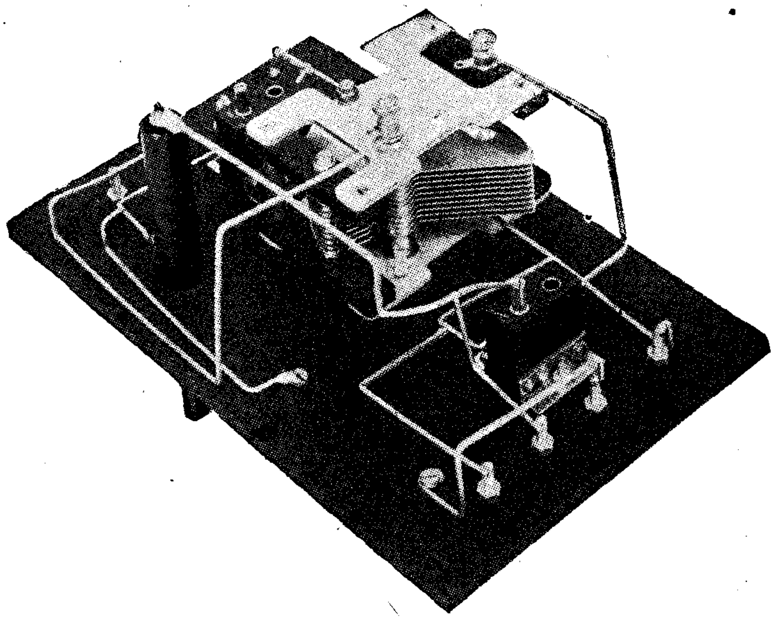


Fig. 3.—Details of the panel layout, blueprint No. 164a, free



The coil holders are spaced well apart.

Materials

The materials employed in the construction of this set are given below, but it will be realised that it is not absolutely essential to employ the components stated as long as those substituted are of equal efficiency, such as advertised in the columns of this journal :—

One ·0005 variable condenser, low loss (Ormond Engineering Co., Ltd.).
One Neutrovernia condenser (Gambrell Bros., Ltd.).
One crystal detector (Service Radio Co., Ltd.).
Two single-coil holders (Burne-Jones & Co., Ltd.).
One ebonite panel, 9 ins. by 5¾ ins. by 3/16 in. (Peto-Scott Co., Ltd.).
One cabinet to take above panel, 6½ ins. deep (Carrington Manufacturing Co.).
One packet Radio Press panel transfers.
Eight terminals and a small quantity of square wire.

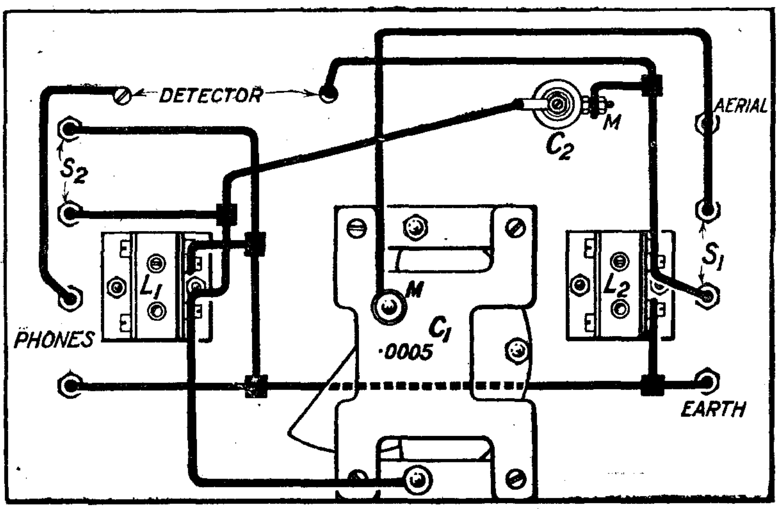


Fig. 4.—The wiring diagram, which may be obtained in blueprint form, blueprint No. 164b, free.

Layout

It will be seen from the photographs that no baseboard is employed for this set, all components being mounted directly on the panel. If the wiring diagram is studied in conjunction with the photographs and panel layout no difficulty should be encountered in mounting the components and wiring up. Care should be taken, however, to see that the coils when placed in position do not foul the wiring, and also to make sure that the vernier condenser is suitably located.

Coils to Employ

It is very important in a set of this description to select a plug-in coil for the local station of a reasonably low H.F. resistance, a No. 75 being of suitable size. The coil for Daventry's frequency, which serves as a choke for the other station, should also be of good quality and low loss, but this is not so important as in the case of the other coil. An average size for the large coil is a Gambrell E.1 or its equivalent in numbered makes.

Test Report

Tests were carried out on an average aerial about 13 miles north of 2LO, and the set gave good results, the signal strength being improved by decreasing the capacity of the vernier condenser. A marked increase in selectivity was also noticed when the vernier condenser was near its minimum. Signals received from Daventry were of average strength, as would be expected, since for Daventry this set is of the conventional type.

These results were confirmed by tests carried out at our Elstree laboratories, and the set should prove useful in those coastal districts where interference is prevalent.

The actual current obtained at the laboratories with this set when receiving London was 40 microamperes, which is only slightly less than that given by the standard set. There is a decided advantage in selectivity, however, and the use of the vernier condenser forms a good method for deriving results similar to those with a tapped coil.

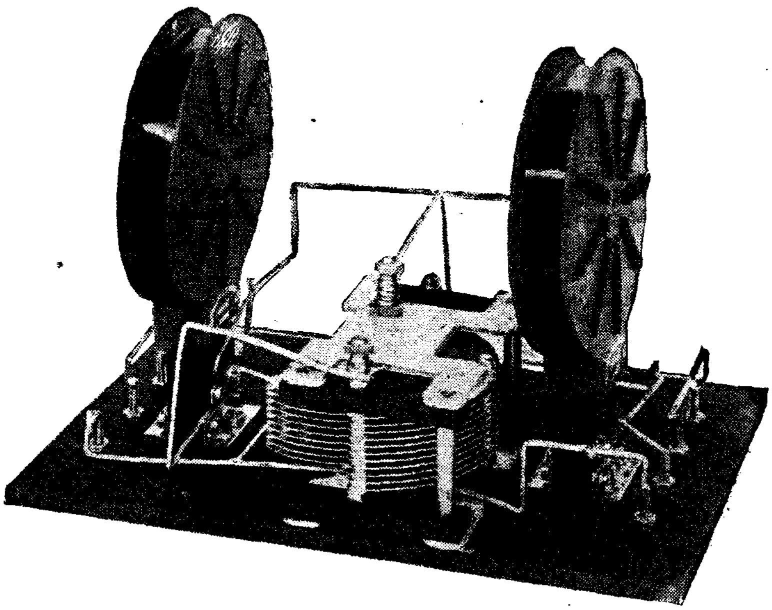
Crystachoke Circuits

The particular circuit chosen for this receiver is one of the "Crystachoke" arrangements featured recently in *Wireless*, and it is seen that it involves the employment of a vernier condenser. An H.F. choke is also provided for the purpose of by-passing the low-frequency current. Thus, although it is necessary to employ an additional control, *i.e.*, the vernier condenser C_2, since this enables one to adjust the crystal load to its best possible value and thus attain maximum signal strength, the extra complication is amply justified.

Increased Selectivity

Apart from the increased volume thus obtained, a feature which will appeal to those troubled by interference is the additional selectivity provided. This is partially due to the removal of part of the crystal load from the aerial circuit by means of the vernier condenser. It is, however, also partly due to the employment of series tuning.

If interference is very bad then the experiment may be tried of reducing the capacity of the vernier condenser below that requisite for maximum signal strength. It is, however, seldom desirable to resort to the rather drastic measure of increasing selectivity at the expense of volume.



As is usual with a crystal set, the wiring should present no difficulties.

The Aerial

It is a curious fact that the better the design of a crystal set the more susceptible it is to improvements in the aerial and earth system. This is really due to the fact that the losses being minimised in the set itself, those remaining in the aerial and earth system become, in proportion, of greater importance. It is therefore desirable if the best results are to be attained to pay due attention to the aerial and earth system.

Methods by which improvements can be effected have been described from time to time in Radio Press journals. Here it may be simply suggested that provided all joints in the aerial and earth leads have been well made then attention may be profitably directed to the trial of different types of earths in order to find the most effective. A few experiments of this nature will be amply repaid by the increased signal strength obtainable.

About Valve-Holders

By JOHN W. BARBER

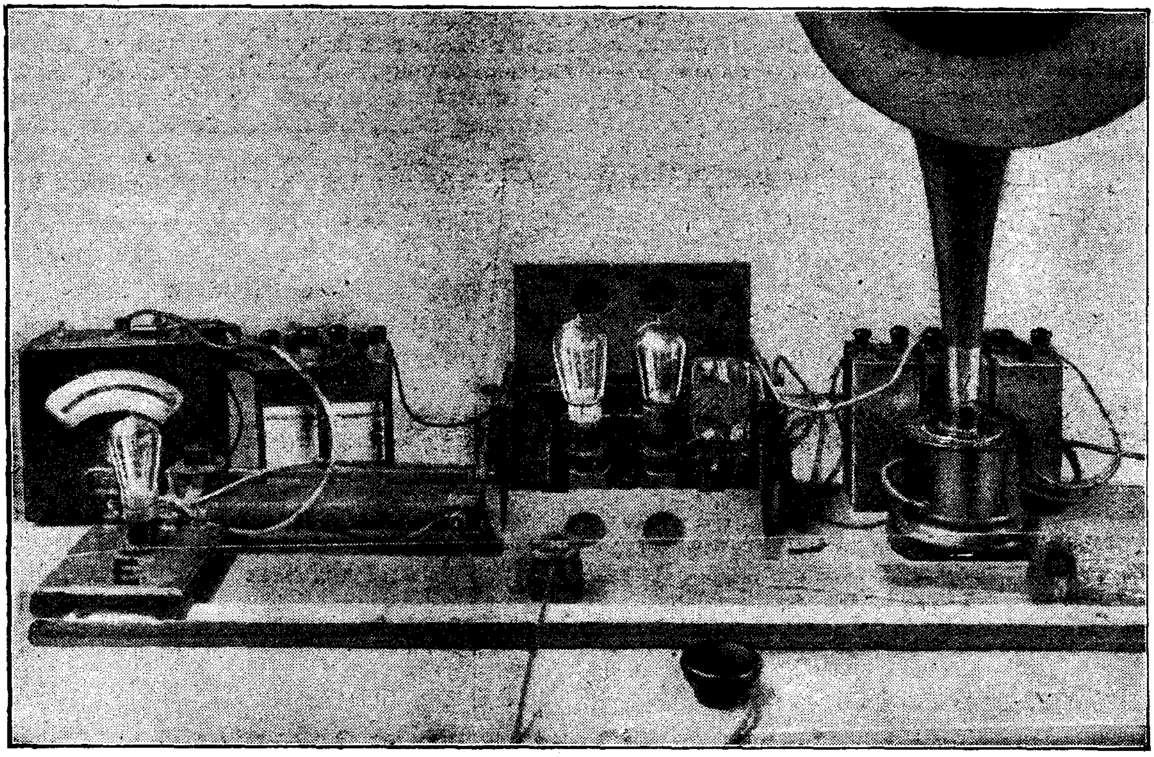
This story of the development of the valve-holder, a component whose design is probably taken for granted by many wireless users, forms in a sense an epitome of the development of the whole art of wireless components and receiving apparatus generally.

IN reviewing the various types of valve-holders and their application in different circumstances, it will be of interest to discuss the earlier forms, and to see why these fell into disuse, for any reasons which may obtain, other than considerations of stimulation of interest by the introduction of something new and unusual.

Early Days

In the early days of broadcasting, the average receiving set was composed of a flat type box with the panel mounted in a horizontal position, all components being secured to the panel. In such receivers, the valve-holders consisted either of solid mouldings, in which were set the sockets for the valve pins, or of the separate sockets, mounted on the panel by the constructor himself, usually with considerable difficulty in obtaining the correct spacing. A well-known firm then introduced a holder consisting of the four pins, correctly mounted on a small circular piece of ebonite, which could be used as a drilling template, or secured directly to the panel by means of a centre screw, the stems of the sockets passing through holes drilled in the panel.

Various modifications of this type appeared, until, with the advent of sloping front cabinets, as well as those in which the panel, still carrying the majority of the components, assumed a vertical position, a form of back-of-panel holder made its appearance. This was arranged to be secured to the panel, the valve being held parallel to it, while the necessary connections were made by means of screws or soldering tags.



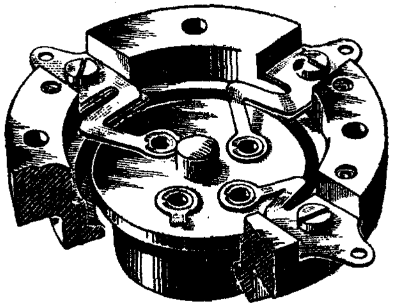
The apparatus shown here is that used by the R.A.F. for investigating the causes and eliminating the effects of the microphonic noises especially familiar to users of dull emitter valves.

A Modification

An interesting modification of this idea comprises a valve-holder, filament rheostat, and switch, combined as one unit, and secured to the panel by the now popular one-hole fixing method. Another similar contrivance comprises the holder and a filament resistance only.

Anti-microphonic Valve-holders

All these forms of valve-holder, while exceedingly interesting and quite satisfactory during the reign of the bright-emitter type of valve, rapidly



An example of the flat spring type of antimicrophonic valve-holder.

fell into disfavour with the advent of the dull-emitter, with its attendant tendency to "ring" at the slightest provocation. A valve-holder was then produced with spring mountings, designed to protect the valve from shock, and to prevent the objectionable "ponging" so caused.

"Low-capacity" Types

Such was the noise made by the earlier dull-emitter valves even on the slightest vibration, that before long other forms of anti-microphonic holders made their appearance. By this time, however, the "low-loss" era had descended upon us with full force, and the valve-holder was by no means immune from the attacks of those bitten by this germ. The manufacturers, therefore, had "low-capacity" as well as "anti-microphonic" to consider in the design of their valve-holders, and at the present time many excellent designs embodying the principles of both doctrines are available. A notable attempt to produce a really low-capacity socket consists of a ring of bakelite, upon which are mounted four phosphor-bronze springs, each of which carries a socket for a valve pin. The sockets are thus separated entirely by air, while the possibility of leakage is greatly reduced, due to the distance apart of the screws securing the springs to the insulating ring. Such a holder proves of considerable utility in circuits where minimum capacity is desirable, such as the present-day short wave arrangements.

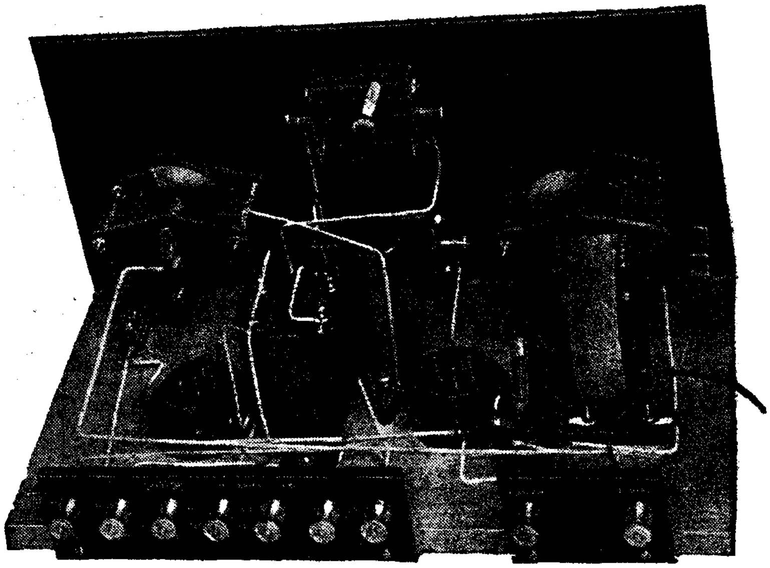
Baseboard Mounting

These types of valve-holder were equally suited to the "American" type of receiver which is now so popular, namely, that in which the panel is disposed vertically with respect to a baseboard, upon which the majority of the components are mounted, the controls alone, in general, being secured to the panel.

This brings us to the present-day receiver, and our attention is thus directed to the valve-holders at present available. The anti-shock types already mentioned are in the forefront of favour, and recently cheaper types have made their appearance. One very useful pattern has both

In these holders sponge rubber is used to prevent shocks from affecting the valve.

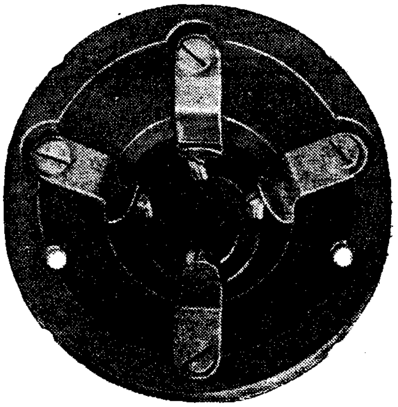
terminals and soldering tags. For the experimenter who is constantly trying out new arrangements of circuits, terminals on a valve-holder are just as useful and necessary as terminals on any other component, as the time wasted in soldering and unsoldering the wires which have to be altered with the circuit may quite easily mount up and constitute a large proportion of the total time taken to alter a circuit.



The modern baseboard-mounting anti-microphonic valve-holder occupies rather more space than the older panel-mounting valve sockets, but represents a notable advance in the design of wireless components.

Electrical Contact

The question of electrical contact between the socket which receives the valve pin, and the terminal or soldering tag to which the external connection is made, is one of vital importance, and should receive due care and attention from the prospective purchaser of a holder. Any slackness of joint, or corrosion due to atmospheric action, which may occur, for example, between the head of a screw and a wire secured thereunder, will cause cracklings and other undesirable effects to take place, and a joint which is actually loose may be the cause of a receiver refusing absolutely to function, or alternatively be the cause of its working in an erratic and thoroughly unsatisfactory manner.



A low-capacity type of holder in which a "wipe" form of contact is used, the contact strips being kept clean by the action of inserting and withdrawing the valve.

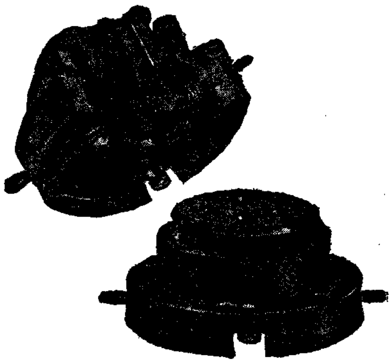
Preventing Accidental "Burn-outs"

In view of the high price of valves, some form of protection is called for, in order to prevent damage to the filament being caused by accidental surface contact of the filament legs of the valve with that part of the socket which is connected to the positive high-tension lead. Many manufacturers of valve-holders in which all four pins are set in a moulding of bakelite or other insulating material, overcome this possibility by setting down the metallic portions of the sockets into the moulding, so that contact is not established until the valve is inserted some way, and as it is not usually possible to insert the valve incorrectly, at any rate without considerable force, the likelihood of damage is so reduced as to be practically negligible.

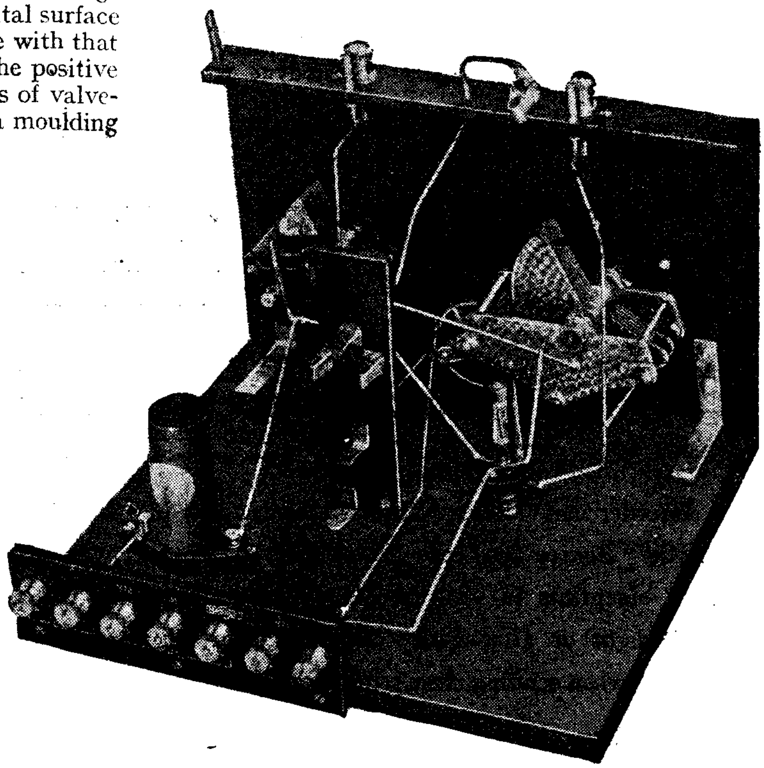
The tubular low-capacity type of valve requires a special holder with its contacts arranged to suit the positions of the contacts on the valve itself.

Spring Tension Important

Springing is another important feature in an anti-shock type of component. Some holders are all that can be desired when used in conjunction with the lighter types of valve, but as soon as a heavier valve is employed, the holder is sadly wanting in the very attribute which it claims to possess, as the valve weighs down the spring portion to such an extent that it is resting, or nearly so, upon the rigid portion, and consequently any shock which occurs is transmitted to the valve. On the other hand, the writer has in mind a holder in which the springs are so strong that it takes a far larger and heavier valve to obtain the correct amount of springing than would in general circumstances be employed, and in ordinary use, therefore, the holder does not fulfil the requirements of its class.



In these anti-micropnonic holders the design is such that no straining of the springs can occur in putting in or taking out the valve.



Special Types

In these notes I have purposely omitted any reference to special types of holder, such, for example, as the holder for the V 24 type of valve, as these holders are each designed for one particular valve, and thus are not of general interest.

Bradford Readers Hear the "Elstree Six"

MANY hundreds of MODERN WIRELESS readers have already heard the "Elstree Six" working in conditions so difficult that even superheterodyne receivers have been baffled. Under the auspices of the Bradford Radio Society, Mr. H. J. Barton-Chapple gave a lecture at Bradford, on the 30th April. The subject of his address was "Modern Developments in Broadcast Reception," and advantage was taken of the occasion to exhibit and demonstrate the "Elstree Six" receiver.

Conditions Not Ideal

Great interest had been aroused in the district, and the size of the audience was ample evidence that an advance demonstration of this remarkable receiver was thoroughly appreciated. An indoor aerial was employed, and owing to the position in which the building is situated the reception of distant broadcasting is always rather difficult.

A Further Difficulty

In addition to this the lecture hall was situated about 200 yards from the local broadcasting station. In spite of this, however, it was possible to cut out the Bradford station with a two degree movement of the condenser dials, and many distant stations were obtained.

A Remarkable Achievement

This test of selectivity speaks well for the receiver, and could not have been achieved with any but this remarkable set. A superheterodyne receiver in the same building was found to give very poor results on a previous occasion, so that the reception of broadcasting stations such as Bournemouth, Aberdeen, Manchester, Hull, Hamburg, Newcastle, Madrid, London and Brussels redounds to the credit of the "Elstree Six."

In their issue dated May 1, under the title "Radio's Achievement," the *Yorkshire Evening Argus* stated ". . . . Mr. Barton-Chapple exhibited and demonstrated a new receiver, the 'Elstree Six.' Although only about 200 yards from the Bradford station, he succeeded in tuning in a number of distant stations without local interference."

In an issue of the same date the *Yorkshire Observer* also gave a full description of the lecture, and in conclusion commented in a similar manner.

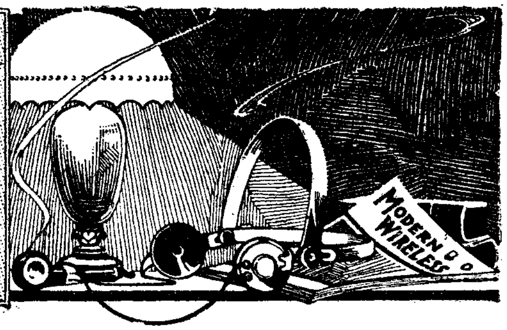
HEAR THE "ELSTREE SIX" AT WORK.

SPECIAL INVITATION TO "MODERN WIRELESS" READERS.

In order that "Modern Wireless" readers may judge for themselves the remarkable efficiency of the "Elstree Six," the Editor invites each purchaser of the first five hundred "Elstree Six" blueprints to visit the Elstree Laboratories and try the original set for himself, either in daylight or after dark. Applicants for blueprints should ask for "Elstree Invitation Form" when sending their remittances.

SPECIAL NOTE.—Owing to the large size and high cost of the "Elstree Six" blueprints, it has been found impossible to include these in the free blueprint scheme announced on another page. The charge for each front-of-panel or wiring diagram blueprint is 1s. 6d. post free.

The Dry Battery
And How It Works



With the increasing popularity of the dull emitter valve, dry batteries are coming into more common use for filament lighting, in addition to high-tension supply. In this article the principle of the dry cell is explained in a clear and easily understandable manner.

As long ago as 1868 a French investigator named Léclanché invented a battery or cell which had such useful characteristics that it has become one of the most common batteries in modern use. The original cell which he devised was a wet cell. It contained two electrodes, a positive and a negative, contained in a suitable jar which was filled with an electrolyte or active liquid. The two electrodes were a zinc rod and a carbon rod surrounded by manganese dioxide in a suitable form, and the electrolyte was ammonium chloride, or, as it is popularly known, "sal-ammoniac."

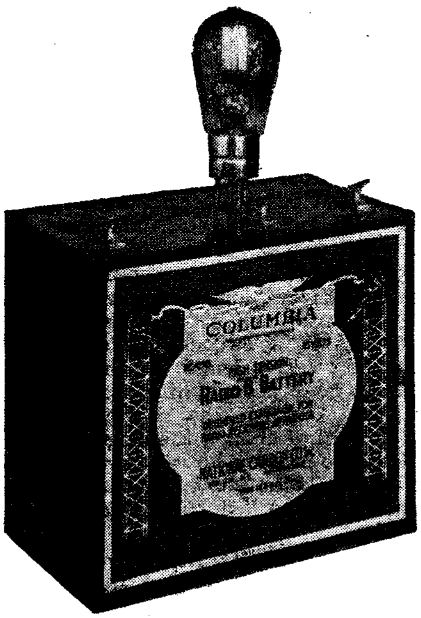
The Question of Voltage

The action of the cell is as follows. Practically all substances possess a certain capacity for doing electrical work, or as we say, a *potential*. This potential is defined with reference to some other factor, and the resulting potential difference is measured in volts. The potential difference between carbon (surrounded by manganese dioxide as it is in this particular case) and ammonium chloride is of the order of 1 volt. In addition to this we have a potential difference between the ammonium chloride and the zinc which amounts to 0·5 volt. Thus the total potential difference between the carbon electrode and the zinc electrode is the sum of these two voltages which amounts to 1·5 volts.

A Chemical Action

If the two terminals are connected through a circuit then a current will flow through the wire, completing the system by means of the cell itself. In order to supply the energy for this current the zinc is dissolved by the ammonium chloride solution, and as a result we obtain a definite chemical change inside the cell. The zinc is turned into zinc chloride and ammonia and hydrogen gases are liberated. The ammonia is soluble in the water of the cell, whence, after a certain time, it begins to escape as a gas. The hydrogen, however, is not soluble and is carried with the current to the carbon electrode, where it clusters round the rod and forms a barrier to the current.

Do you know why a dry battery drops in voltage with use? Why does it lose its efficiency if it is kept for a long period, and how can this trouble be remedied? These queries and other interesting questions are answered in this discussion on the subject.



Special large cell H.T. batteries are obtainable for use with power amplifiers and multi-valve sets. Comparison between the 45-volt unit of the type seen in this photograph and the small power valve enables one to form an opinion of the size of these batteries.

Polarisation

This action is known as *polarisation*, and when this takes place the voltage of the cell rapidly falls to a very small value and so the cell becomes useless. It is for this purpose that the carbon electrode is surrounded by manganese dioxide, which is a black powder. This substance has an affinity for the hydrogen because of the amount of combined oxygen which it contains, and the effect of this is that the hydrogen is oxidised, so forming ordinary water, being thus removed from the surface of the carbon, and leaving the cell in an active condition once again. At the same time the manganese dioxide is reduced, as it is called, to a lower oxide, having lost some of its oxygen, so that it becomes used up in the process.

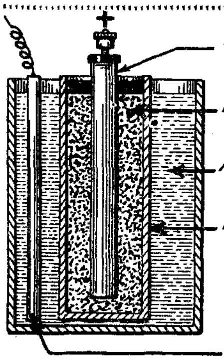
The Dry Cell

It was not until 1888, twenty years after Léclanché's original discovery, that a dry cell was made on the same principles. The only difference between a wet cell and a dry cell lies in the fact that the electrolyte is made up in the form of a paste so that it is not spillable.

The zinc electrode, instead of being made in the form of a rod, is made to serve as the container, so that we have a pot of zinc, a central rod of carbon surrounded by a large volume of the manganese dioxide depolariser, and the intervening space is filled with a paste containing sal-ammoniac as the active part.

Interesting Figures

The voltage developed by a dry cell is not quite so great as can be



A sectional view showing the "make-up" of an ordinary Leclanche cell.

obtained with a wet cell, owing to the somewhat higher internal resistance, but the difference is usually less than 0·1 of a volt. As the cell runs down, however, we have seen that chemical changes take place, and this causes a difference in the potentials existing inside the cell. For one thing, the electrolyte is no longer ammonium chloride, but contains a large proportion of dissolved zinc chloride.

Secondly, the manganese dioxide has largely been used up in removing the bubbles of hydrogen gas round the carbon rod, and the resulting mixture of carbon and reduced manganese dioxide has not such a large potential difference to the electrolyte as it had before. The actual figures are as follows: Carbon-manganese dioxide to electrolyte 0·4 volts. Electrolyte to zinc 0·3 volts, giving a total voltage of 0·7 volts instead of 1·5. Of course when the cell reaches such a condition as this, it is useless for further work.

Limiting Considerations

In practice, therefore, the conditions required are that the cell shall give as long a service as possible before the internal chemical change takes place which causes the drop in voltage. The change in the voltage of course, is not a sudden one, but is fairly gradual in its action. At the same time the voltage falls away very rapidly after a certain limit has been reached, and the cell quickly runs down.

For radio receiving purposes we have two separate requirements. First of all there are cells required for lighting the filaments of dull-emitter valves, known in America as A batteries, and secondly we have batteries for providing high-tension voltage or grid-bias voltage known respectively as B and C batteries in the same country. The conditions of service are somewhat different, and it will be as well to discuss the two classes of cells separately.

Filament Batteries

The requirements of the filament battery are that it shall give a reasonably large current for a considerable period. The current supply is comparatively intermittent, lasting from 2 to 5 hours a day on an average.

Now the depolarising action due to the oxidisation of the hydrogen by the manganese dioxide is not very rapid. If the battery is intended to give a continuous service, therefore, a considerable quantity of manganese dioxide must be provided round the carbon electrode, and it must be so applied that it has easy access to the free hydrogen which is to be removed. For this reason it is customary to provide between three and four times as much manganese dioxide as is theoretically necessary in order to accelerate the depolarising action where possible.

Discharging and Recuperating

Even so, a small amount of polarisiation takes place, and the voltage of the cell drops gradually during use. During the period when the battery is switched off, the depolarising action, continues, so that the cell recuperates to a large extent. Now the actual life of the battery before its final voltage drops below the permissible limit depends in a considerable degree on the relative length of the discharge and recuperation periods. Up to a point the shorter the periods of discharge, the longer the life of the battery, but we have here another factor coming into play, known as the "shelf" life of the battery.

"Shelf" Life

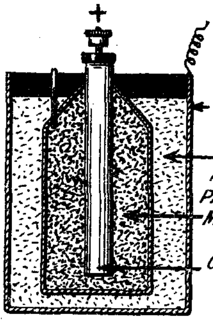
If a battery stands for some time without any current being taken from it, very small chemical reactions take place inside the cell, largely due to the presence of minute impurities in the chemicals, and ultimately this will cause local action at the zinc electrode resulting in the zinc being dissolved by the sal-ammoniac, although no current is being passed. This in time will cause holes to appear in the zinc container, and by the time the action has proceeded to this stage, a considerable internal change has taken place inside the cell, and the voltage has dropped considerably below the normal. Thus, if a cell is kept on the shelf for a considerable period, it will lose its voltage automatically, and become useless.

Using for Short Periods

Now this internal action comes into play when the battery is used only for comparatively short periods. If the battery were switched on only half an hour a day and left with the remaining 23½ hours to recuperate, then its life would be so long that the deterioration which goes on all the time during the shelf life would begin to take effect here, and the battery would begin to lose its voltage from this cause.

Optimum Conditions of Service

The best conditions under which to use a battery therefore depends upon its shelf life. The less a battery is used, the longer becomes the life up to a point where the internal reactions begin to cause the voltage to drop irrespective of the current taken from it. This means, therefore, that if the battery is used for only a small number of hours every day then the current which is taken from it can be increased. For example, in some tests which were recently made on several large dry cells the maximum service when the battery was used four hours every day was



In the case of a "dry" cell the electrolyte takes the form of a thick paste.

obtained with a discharge of 100 milliamps, whereas when the cell was only used two hours a day, the best discharge was 200 milliamps.

It will be seen that these figures bear a definite relationship. The results were taken on a standard type of battery, 2½ in. diameter and 6 in. high, so that these figures may serve as a guide to other users. For this type of cell, therefore, the product of discharge in milliamps and hours per day =400.

Cells in Parallel

If the average hours of service per day are known, then from the figures just given the best discharge rate can be estimated, and sufficient batteries placed in parallel to give the optimum conditions. For example, if we require to run three 60 milliamp. valves from dry batteries, and they are to be used on an average three hours a day, then one single set of the batteries will suffice. If longer service is required running to an average of perhaps five hours per day, then the optimum discharge rate for each battery would only be about 80 to 90 milliamps, so that two banks of cells in parallel should be used in order to supply the 180 milliamps required.

High-Tension Batteries

When we come to the question of high-tension batteries the life of the battery is not such a serious matter, because the current taken from the battery is much smaller and it is shelf life which usually is of importance in a case such as this. Moreover a most important requirement is that the internal resistance of the battery shall be constant. With the smaller cells inside the batteries, it is not possible to keep the actual internal resistance anything like as low as a filament battery, the internal resistance of a single cell ranging from 0·2 to 0·5 ohm as against something like 0·05 for a large filament battery.

A Constant Resistance

It is important, however, as was just mentioned, that this resistance shall remain constant, as otherwise whistling and howling in the amplifier may be set up, or, if the state of affairs is very bad, continual crackling will result. Particularly with this type of battery, there is a considerable difference between an intermittent and a continuous discharge, owing largely to the much smaller available quantity of active material in a small battery. A battery which will give 150 hours' service on continuous rating before dropping to 1 volt per cell would give about 280 hours' life if discharged intermittently for four hours a day with a 20 hours' rest.

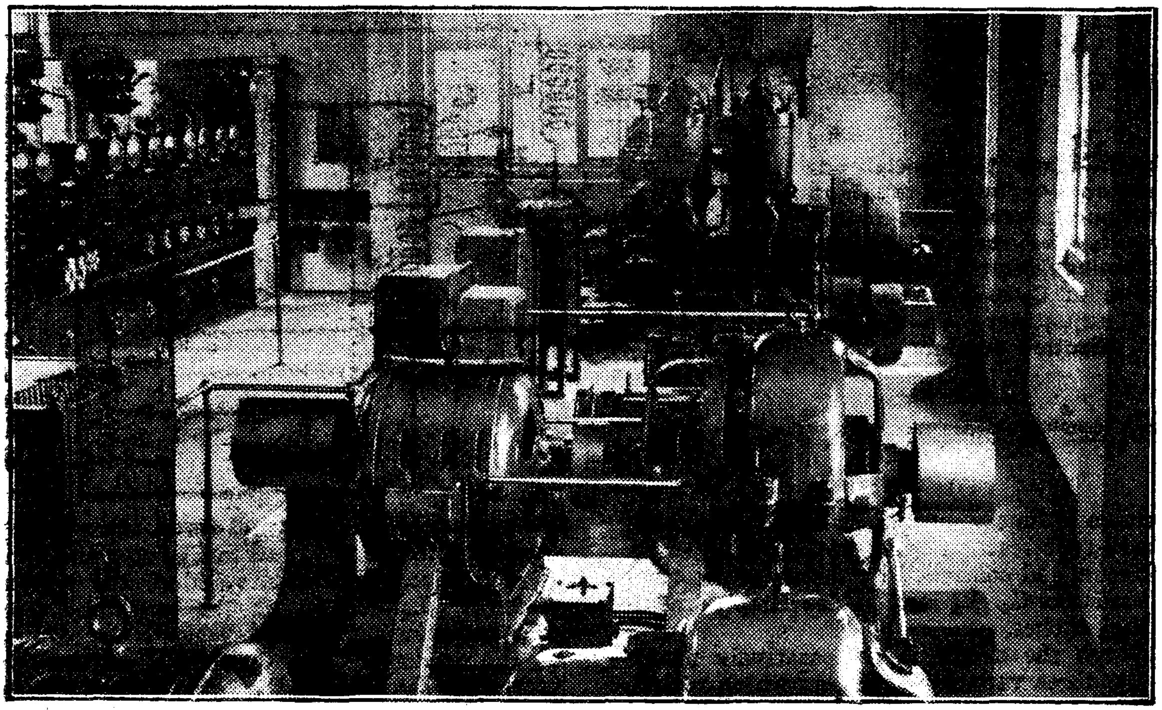
Insulation

In order to keep the shelf life long, and to keep the internal resistance constant, great care has to be taken in the insulation between the individual cells. If this is not done, then continual small leakage currents will flow which will cause the battery to run down very quickly, quite apart from the unpleasant noises which will be set up in the circuit by the flow of these leakage currents. For this reason the ordinary flash-lamp battery is not always suitable for high-tension, because the insulation in such cases has not to conform to such a severe standard, and is not quite adequate for the somewhat exacting requirements of a good high-tension battery.

A Proper Balance

In conclusion, therefore, it will be seen that the design or choice of a high-tension battery depends entirely upon an adequate balance between the capacity and the shelf life. Obviously the largest battery possible should be chosen for any given load, provided that it obtains a reasonable shelf life. There is no economy in using large batteries if they lose their efficiency during the period of recuperation. These points, however, are usually borne in mind by the dry cell manufacturers, and as a result of exhaustive research work, there are now a large number of batteries on the market specifically designed for the stringent and exacting conditions of wireless service.

Have You Read the Details of Our New Free Blueprint Offer? See page 77.



The Post Office high-power station at Northolt is well-known to listeners. Here we see the switchboard and a number of the generators.

Which Adjustment Must I Make First?

By
A. JOHNSON-RANDALL

Methodical tuning is a considerable aid to the successful operation of a receiver, and in this article the author indicates clearly the best procedure to adopt.

HOW can I operate my set to its best advantage?—is a question frequently asked by the beginner. He knows, for instance, that he will receive some signals by means of haphazard adjustment, but he feels that in order to obtain the best results he should follow some ordered procedure. He is quite correct, since, as in all things, there is a right and wrong method of going to work, so with a broadcast receiver there is a best method of adjusting the dials if the fullest effect is to be obtained.

A Circuit for Discussion

Take, for instance, the type of circuit shown in Fig. 1, which consists of a high-frequency valve V_1, followed by an anode-current rectifier valve V_2. It will be seen that tuned grid circuits and adjustable primary windings are employed, Reinartz type reaction being used on the second grid circuit and controlled by means of the variable condenser C_4. L_3 and L_7 are simply radio-frequency chokes.

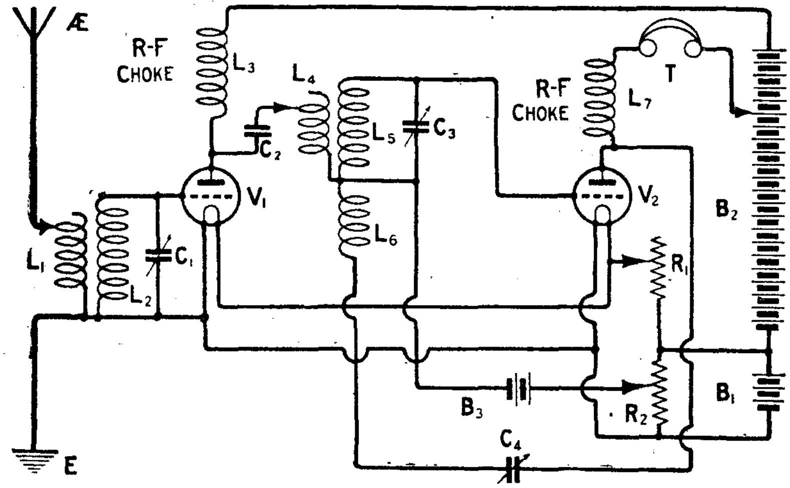


Fig. 1.—Once the initial adjustments of the coil tappings have been carried out in this circuit, the tuning is controlled by simultaneous movements of C_1 and C_3, with a final adjustment on C_4, the reaction condenser.

Although the circuit is comparatively simple there are three variable condensers which require adjustment and two small primary windings.

Initial Difficulties

The novice can therefore be pardoned if at first sight the problem causes him a little worry. Let us consider for a moment the purpose of each of these adjustments. The tapping on L_1 enables the best combination of signal strength and selectivity to be found on a given aerial and to cover a certain waveband with a good measure of efficiency. C_1 permits the grid circuit of V_1 to be tuned to the frequency of the required station. C_3 serves the same purpose for V_2, while L_4 may be adjusted to suit the valve V_1 and requires adjustment once only for any particular valve. C_4 is the reaction condenser.

Operating Details

To operate the receiver place the L_1 tapping about half-way, that is to say, so as to include approximately half the total turns. Carry out a similar procedure in regard to L_4, but if the valve V_1 commences to oscillate reduce the number of turns. L_2 and L_5 should be similar sized coils, hence for any given wavelength the readings on the condenser dials C_1 and C_3 will be very nearly the same. Place the dial of the reaction condenser C_4 at zero and rotate C_1 and C_3 together

When signals are heard adjust these two condensers for the best results and then rotate C_4.

The Reaction Condenser

As C_4 is increased the strength of signals will also increase, provided L_6 is connected correctly in relation to L_5, and a point will finally be reached when oscillation will commence. The final position of C_4 should be below this point. After this a slight readjustment of C_3 may improve matters.

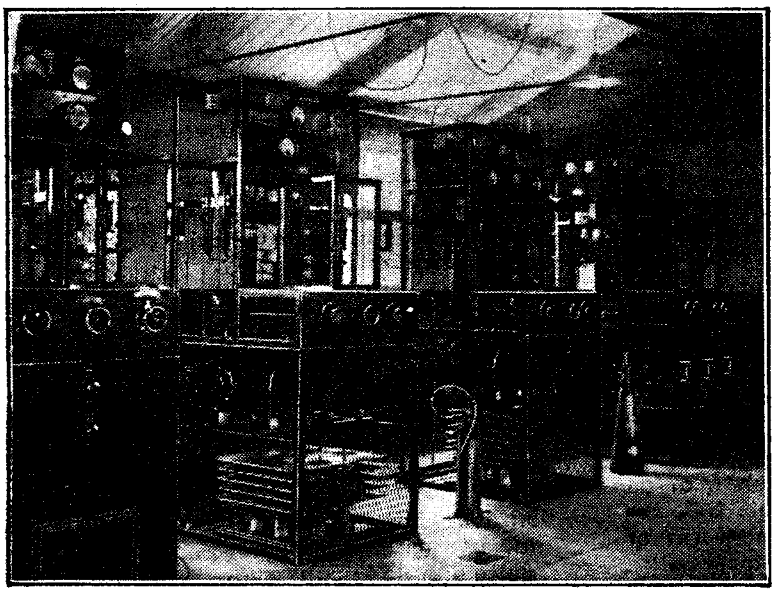
The position of the tapping on L_1 is a matter for experiment, so also is that upon L_4. Both of them should be varied, and when once a suitable adjustment is obtained they can be left, the control then being carried out with the condensers C_1, C_3 and C_4.

Rotate the Condensers Slowly

It should be remembered that in searching for distant stations the two tuning dials C_1 and C_3 must be rotated very slowly, and with each increase it will usually be possible to follow up this movement with a correspondingly small increase in the value of C_4. If, however, C_1 and C_3 are to be decreased suddenly, C_4 must be diminished first or self-oscillation will in all probability occur.

Another Popular Circuit

Fig. 2 shows another form of circuit which still retains a well deserved popularity. It consists of a "semi-aperiodic" aerial coupling, together with a tuned anode with reaction on to the anode coil. Reaction control is by means of a swinging coil, and there are therefore only two condenser dials to adjust.



Accessibility of the transmitting equipment is a feature of the Dublin broadcasting station.

In practice the tapping on L_1 would be at about 10 to 20 turns from the earth end of the coil for the broadcast band, and the normal operating procedure is to vary C_1 slightly, say, a degree or two at a time, and to rotate C_2 over a large portion of its scale. The arm of the potentiometer R_3 would be placed about half way along the resistance element.

Adjusting Reaction

Signals having been received, the reaction coil L_3 may be brought nearer to the anode coil L_2 with beneficial results. It will then be found necessary to readjust C_2 by decreasing its value slightly. The final adjustment would be carried out by moving the potentiometer arm towards the negative end, but not so far that the valve V_1 commences to oscillate.

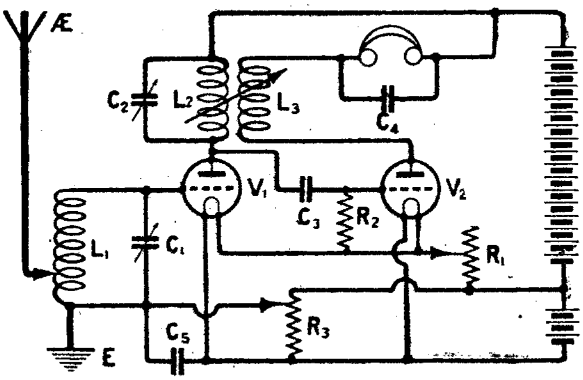


Fig. 2.—In the popular tuned anode with reaction circuit, searching is carried out with C_1 and C_2, the reaction coupling between L_2 and L_3 being subsequently tightened for the best results.

An Outcome of Practice

After a little practice the approximate positions of C_1 and C_2 will be known for any given station and the adjustment will be the matter of a few seconds. It is as well to bear in mind that careful tuning when searching is more likely to give good results than is the common practice of setting the receiver into oscillation and swinging the condensers wildly in an attempt to "strike" a carrier wave.

The Better Method

In the former instance the required station will be brought in without interference with one's neighbours, and the reproduction will be undistorted, whilst in the latter case it is highly probable that upon bringing the receiver out of oscillation the signals will be lost and searching will have to be commenced once more. The first is a good example of skilful manipulation and the second a case of gross mishandling.

The Wavemeter Simply Explained

By

H. J. BARTON-CHAPPLE

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The wavemeter is perhaps one of the most valuable pieces of apparatus the enthusiast can possess, and readers will find this simple explanation of the elementary principles of great interest.

IT is perhaps unfortunate that an instrument which is such an important asset to the experimenter and home constructor should have been named a wavemeter, because under working conditions the apparatus does not measure wavelengths at all.

A Familiar Phenomenon

The fact that a condenser and inductance when connected in series can be made to oscillate at a frequency which depends upon the constants of the circuit is a phenomenon familiar to all MODERN WIRELESS readers, and a wavemeter is essentially a device which makes use of this principle. Now the instrument which is the subject of this article really measures the frequency of the oscillations in a particular circuit, for there is a definite relationship between frequency and wavelength, and we have got into the common habit of speaking in terms of wavelengths when the more correct term would be frequency.

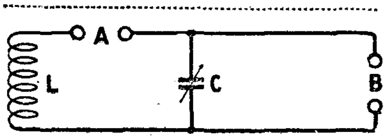


Fig. 1.—A simple form of wavemeter consists of an oscillatory circuit L C, together with some form of resonance indicator.

A Simple Principle

Our wavemeter, then, consists primarily of a closed oscillatory circuit whose natural frequency can be varied at will by adjusting either the inductance or condenser (and sometimes both), and this is brought into a state of resonance with the frequency to be measured. By reference to a calibration chart or curve the wavelength (or frequency) can then be read off quite simply.

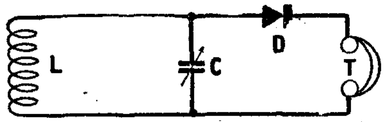


Fig. 2.—A crystal and a pair of telephones form an effective resonance indicator.

Wavelength Range

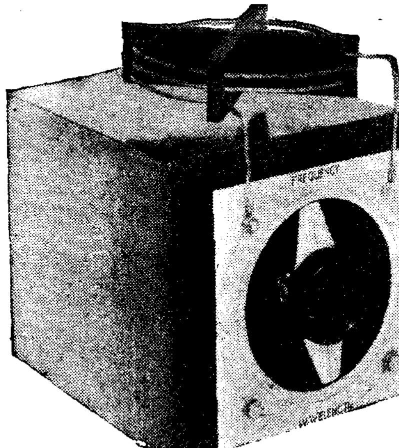
The wavelength range of the instrument will naturally depend on the sizes of the coils and condensers employed in the construction of the unit, and by making the coils interchangeable or being able to increase the maximum capacity of the condenser the total range covered can be made to suit all possible contingencies.

An absorption wavemeter for use with receivers is quite simple in construction and consists merely of an inductance and variable condenser.

The Main Classifications

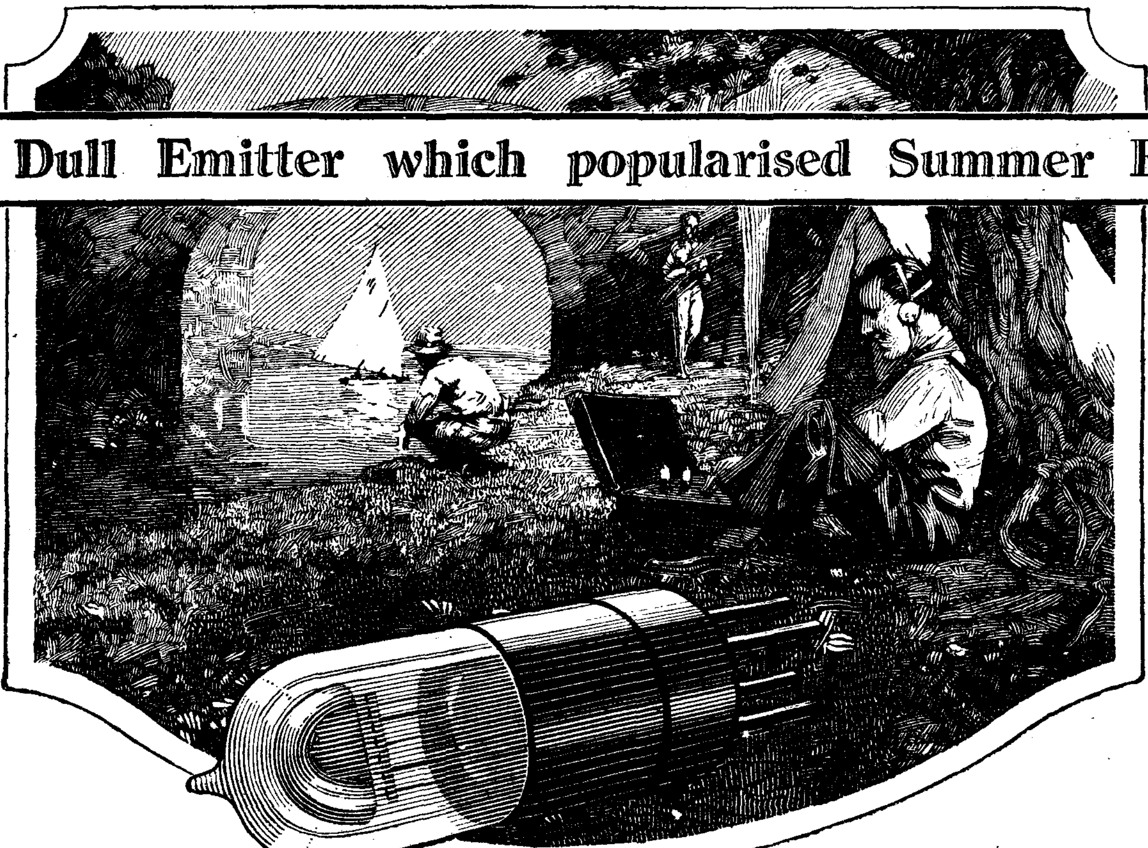
There are two main classifications for wavemeters, namely, valve and non-valve, but one feature is common to both, and that is that there must be incorporated with the design some form of resonance indicator. Actually at resonance the resistance of the oscillatory circuit is reduced to a minimum, or in other words, the current flowing in the circuit is a maximum and the device must indicate this fact either in an audible or visible manner.

Included in these devices may be mentioned the following: Hot-wire ammeter, crystal detector and telephones, crystal detector and galvanometer, thermo-couple and galvanometer, neon tube or neon lamp, small incandescent lamps, etc.



Each of these has its own particular advantages and disadvantages, and taking the simple wave-

The Dull Emitter which popularised Summer Radio



SO long as bright-emitter valves were the only ones available the really portable Receiver was impracticable. No one wanted to carry big 6-volt accumulators out into the country for the pleasure of enjoying a Radio concert in the meadows—it wasn't worth the trouble. And even when the first dull emitters became more popular their extreme fragility rendered them unsuitable for the inevitable rough handling which every Set must get when carried from place to place.

And so the portable Receiver lagged in development. But, with the introduction of the Wuncell, summer Radio becomes a new delight. It is now quite easy to design a three-valve Receiver which can be fitted into an attache case complete with a 2-volt unspillable accumulator. Such a Receiver will give at least 10 to 12 hours' reception on one charge. And, what is more important still, the Wuncell valves will not be harmed by the vibration and rough usage to which such a Receiver must inevitably be subjected.

The reason for this lies in the design of the filament and its method of manufacture. Instead of being a long, straight filament, it is arched and further stayed at its centre with a third support. Instead of obtaining low current consumption by thinning down the filament at the risk of fragility, the Wuncell filament is manufactured under an entirely new process. This permits an exceptionally high electron emission at a temperature of only 800 degrees—when the Wuncell valve is working, its glow is practically invisible in daytime. Even in the dark it is no more apparent than the luminous figures on a watch dial. As a result, therefore, we have every confidence in saying that the Wuncell Valve is quite as robust as even the well-known Cossor Bright Emitter.

Types and Prices:

*W.1. For Detector and L.F. use - 14/-
1·8 Volts. Consumption ·3 amps.
*W.2. (With red top) for H.F. use 14/-
1·8 Volts. Consumption ·3 amps.
W.3 The Loud Speaker Valve - 18/6
1·8 Volts. Consumption ·5 amps.

**Also in special base with resistance to suit 2, 4 or 6-volt accumulator 16/-*

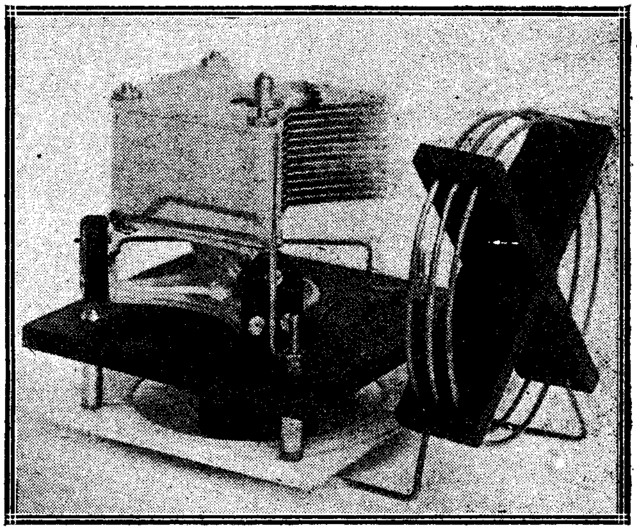
Cossor Valves

Issued by A. C. Cossor, Ltd., Highbury Grove, London, N.5. Gilbert Ad. 5108

meter first (*i.e.*, non-valve type) we will briefly deal with these as the merits of the case dictate.

The Simplest Form

Fig. 1 gives the simplest connections for the wavemeter, *L* and



This back of panel view shows the extreme simplicity of the absorption type of instrument. Absorption wavemeters of the type illustrated are particularly valuable for short-wave calibration purposes.

C being joined in series across the terminals at *A*, between which would be connected a resonance indicator, which depends for its action upon the current flowing through it. The terminals *B* in parallel with the condenser *C* are provided for those devices which rely on the condition producing maximum voltage across the condenser or coil.

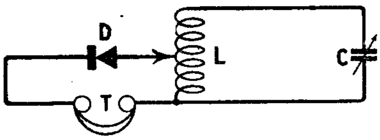


Fig. 3.—Much of the crystal damping is overcome by tapping across only a few turns of the inductance.

Hot wire ammeters and galvanometers have their widest application in laboratory instruments, so will not be dealt with here, especially as the ammeter is really only employed in those cases where the wavemeter is coupled to a circuit of considerable power.

Damping

When the induced currents in the coil *L* are exceedingly small, the crystal detector and telephones are admirably suited for the purpose, and various refinements have been introduced in order to produce sharp tuning (the ideal of all wavemeters), in spite of the damping action of the crystal itself.

Reducing Crystal Damping

Fig. 2 shows the simple circuit with the crystal detector and telephones inserted at *B* of Fig. 1, but difficulties are often experienced as a result of the damping action of the detector and the uncertain external capacity due to the telephones. The former objection is considerably reduced by resort to the method shown in Fig. 3, where the crystal is now shunted across only a few turns of the coil.

The "Unilateral" Method

An interesting circuit is indicated in Fig. 4, this being often called the "unilateral" connection, the telephones and crystal detector being joined in a closed loop and connected to the oscillatory circuit at one point only. Here the wavemeter constants remain unaltered, irrespective of the characteristics of the telephones and detector, thus any pair of telephones, leads, etc., may be employed.

The action of this circuit is attributable to electro-magnetic induction, the field from the coil *L* linking the closed loop and inducing a small E.M.F., which can be rectified and made audible in the telephones. In addition, electrostatic effects have a certain function in the successful operation of the scheme, the main objection to which lies in the small audibility obtained as compared with the other methods.

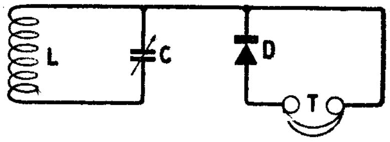
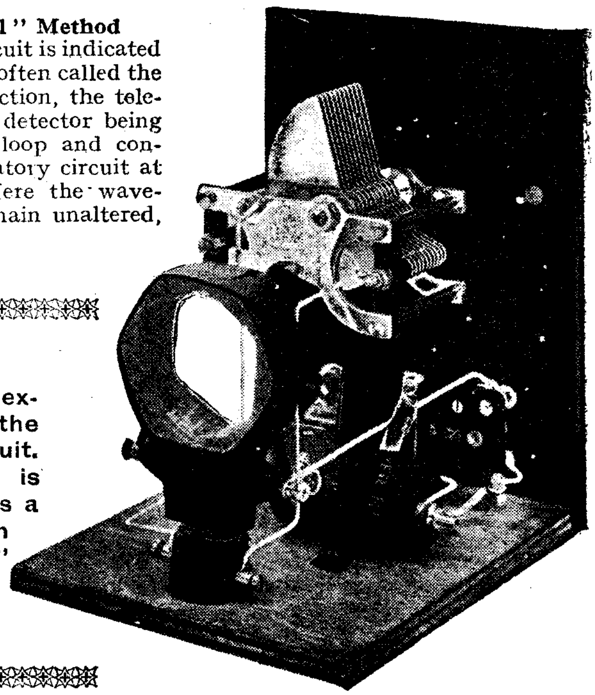


Fig. 4.—This somewhat unconventional circuit depends for its action upon both electro-magnetic and electrostatic effects.

The Neon Lamp

In the case of the neon lamp, which may conveniently take the form of an ordinary Osglim lamp referred to elsewhere in this issue, the condition of resonance is found by observing when the lamp glows at maximum brilliancy. The advantages of this method are that it is simple, while the determinations can be quickly and easily made. The accuracy is not so great as with the other methods, owing to the diffi-

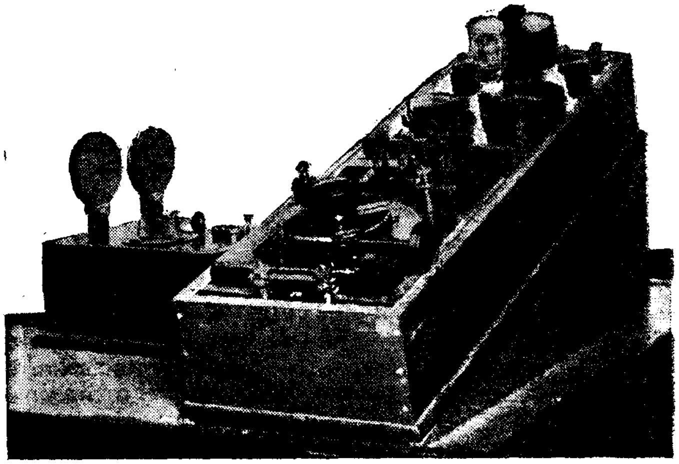


A practical example of the Fig. 5 circuit. The buzzer is joined across a small portion of the "X" coil.

culty of judging maximum brightness, but the method has many applications, especially for transmitting work.

Using a Small Incandescent Lamp

A small incandescent lamp of low voltage (2-4 volt) is sometimes used in series with L and C, i.e., at A of Fig. 1, to indicate resonance, but this introduces an additional resistance in that part of the circuit which, by design, should be " low loss."



The wavemeter at the Elstree Laboratories is one of the most accurate in this country and is controlled by means of a quartz crystal.

All the types just referred to are what are known as absorption wavemeters, since they depend for their action upon the energy which is absorbed from the particular receiver or circuit whose wavelength (or more strictly, frequency) is being determined and one form of the completed absorption instrument is shown in two of the photographs accompanying this article.

Use with Receivers

They find their widest application when used in conjunction with transmitting circuits for spark working, but in most cases can be used with receivers. The absorption of energy from the receiving circuit, which has been tuned accurately to the incoming signal, will cause a reduction in signal strength, and resonance occurs when this reduction is a maximum. Thus by listening on the telephones or loudspeaker for the loss of volume it is possible to judge with a fairly high degree of accuracy the resonant condition and thus log the wavelength of the incoming signal. The wavemeter should be loosely coupled to the receiver.

Buzzer Wavemeters

There are many types of wavemeters which are designed to generate oscillations, and by loose coupling to the receiver these oscillations can be detected and the receiver adjusted to produce maximum sound in the telephones or loud-speaker, thus indicating the required resonance condition. A buzzer is frequently utilised to excite the wavemeter circuit, and the simple scheme of connections is indicated in Fig. 5.

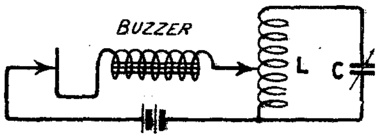


Fig. 5.—Tuning is sharpened by tapping the buzzer across part of the inductance L.

The buzzer is shown tapped across the coil L, and voltage impulses are thus imparted to the oscillatory circuit, the frequency of whose oscillations will depend, as before, on the values of L and C. Difficulties are often experienced in maintaining a constant buzzer note, and this sometimes calls for skill and a certain amount of patience in adjusting the vibrating reed to produce a fairly shrill note.

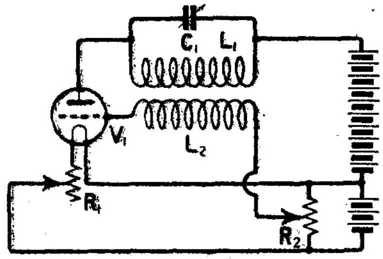


Fig. 6.—The circuit of a simple heterodyne wavemeter.

Heterodyne Wavemeters

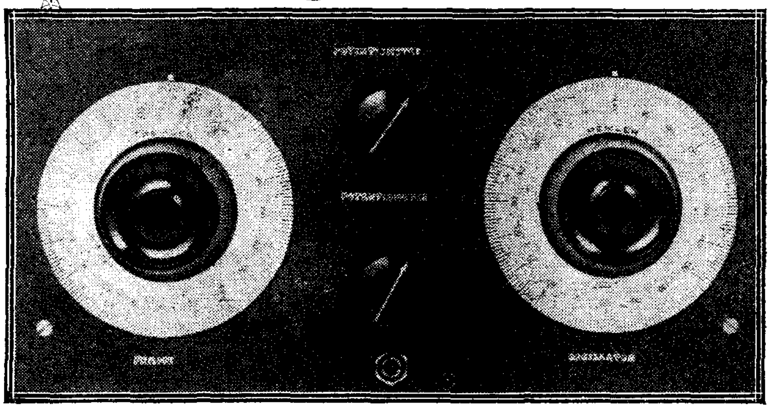
Turning our attention now to valve wavemeters, a simple circuit is shown in Fig. 6. The oscillating circuit L_1 C_1 is connected in the anode circuit, being coupled magnetically to the coil L_2 in the grid circuit, the coupling being kept fixed. Continuous oscillations are generated and maintained in a circuit of this nature, the frequency being varied by an alteration of C_1 or L_1.

The wavemeter is generally referred to as a heterodyne wavemeter, and when working it is adjusted so that the frequencies of the incoming carrier wave and that from the instrument are identical. If there is any difference between these frequencies beat notes will be heard when the wavemeter is loosely coupled to the receiver, due to this frequency difference, and a zero beat note is the condition obtained when the two frequencies are the same.

Quartz Crystal Control

The wavemeter at Elstree makes use of these principles, but in order to secure the accuracy of one part in three thousand, it is controlled by a quartz crystal, and interested readers are referred to *Wireless Weekly*, Vol. 8, No. 3, where complete details of this remarkable instrument were published, while a photograph of the wavemeter is shown in these pages.

Adding Refinements to the Open-air Super-Heterodyne



By G. P. KENDALL, B.Sc.

Many interesting experiments may be carried out with super-heterodyne receivers, and Mr. Kendall makes here some suggestions for refinements in the super-heterodyne published last month.

ONE of the great charms of the super-heterodyne is that to the keen experimenter, to a greater extent than probably any other receiver, it is a constant provocation to try and make alterations which shall prove to be improvements. There are so many things which can be tried, alterations of the oscillator connections, different methods of coupling a stage of high-frequency amplification in front of the first detector, and so on, that even though the set may be giving good results, it requires more than human forbearance to refrain from making constant little modifications in hope of getting something still better.

Interesting Modifications

Certainly, no super-heterodyne which I have ever made has been allowed to stagnate for long, and the portable one which I described in the last number of this journal is no exception. Many alterations and modifications from the design which was published were tried both before and after the appearance of the last article, and it is proposed to describe some of these this month, since several of them are interesting in themselves, and also capable of giving either improved results or more pleasant operation, at the expenditure of just a little time and work upon the set. No serious outlay is involved.

Lower Bend Rectification

A modification which is always worth trying in a super-heterodyne is to employ what is called " bottom bend " rectification for the second detector, instead of the usual grid condenser and leak method. The use of bottom-bend rectification is often found to produce some improvement in the selectivity of the receiver, and a somewhat problematical increase in the purity of reproduction. It is so easy to try that it is usually one of the first things that one does in super-heterodyne receivers, and in the instrument

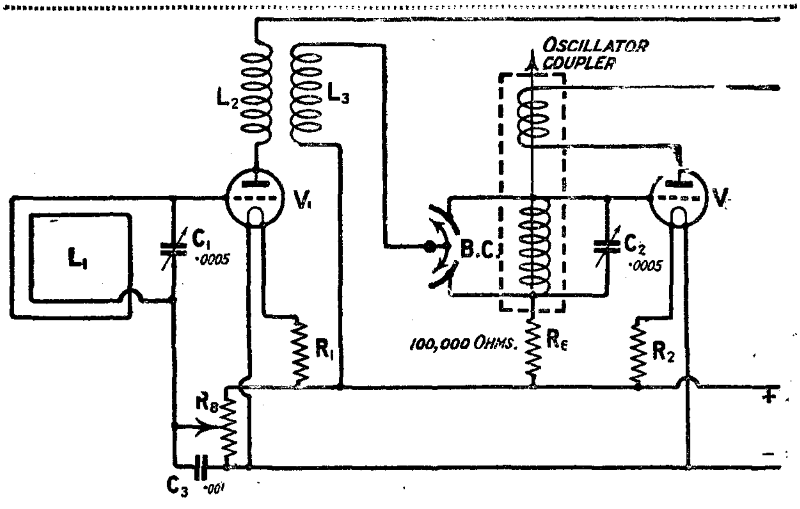
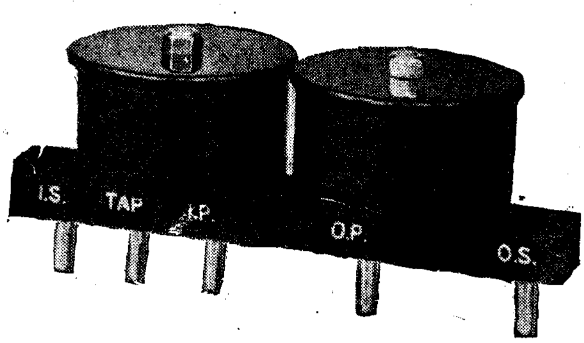


Fig. 1.—By utilising a balancing condenser as shown here, it becomes unnecessary to use a centre-tapped coil in the oscillator-coupler.



A twin-coil coupler may be made up on formers of this type, the conventional mounting for centre-tapped coils being retained.

under consideration it is particularly simple. All that is required is to remove the grid condenser and leak of the second detector, replacing them by a straight connection between the appropriate terminal of the intermediate transformer and grid of this valve, and

In my own set I found that there is no loss of signal strength whatever upon using this method, selectivity is slightly benefited, and the reaction control of the intermediate-frequency amplifier by means of the appropriate potentiometer is decidedly improved. The

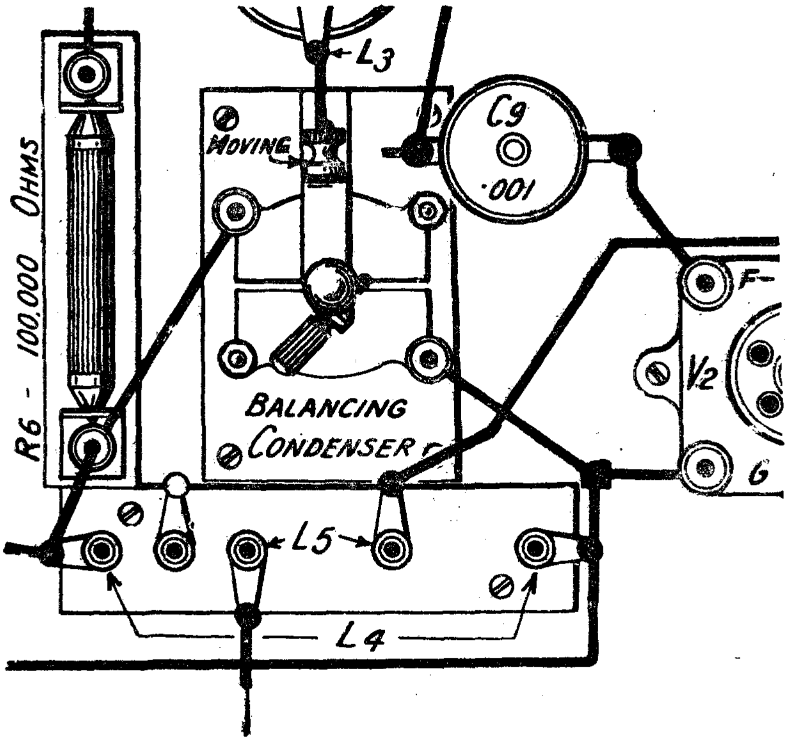


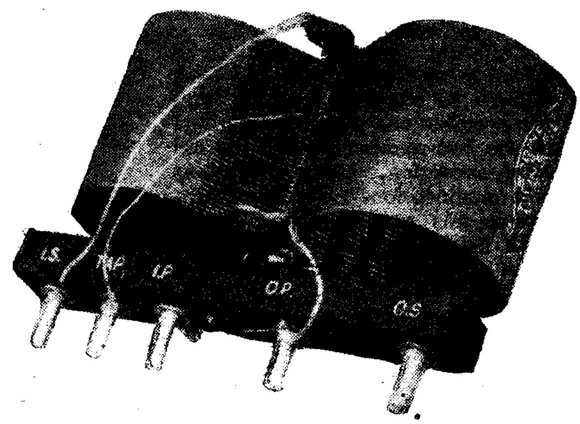
Fig. 2.—The method of connecting the balancing condenser in circuit will be clear from this diagram. Note that no connection is made to the normal centre-tapping contact on the coil mount.

then to remove the connection between the lower end of the secondary of the same intermediate frequency transformer and low tension positive. Instead, attach a flexible lead to the terminal of the intermediate frequency transformer in question, fasten to the end of this a wander plug, and insert it in a suitable socket in the grid-bias battery which is already provided for the low-frequency valve.

The Detector Valve

To get the best results from bottom-bend rectification it is advisable to use a suitable type of valve, such as the special high-impedance valves used for resistance amplification, and other similar types. It will then be found that with about 1½ volts negative grid bias and an easily found H.T. value in the neighbourhood of 60 to 70 volts, good rectification will result.

An improvement in selectivity was found to result from the use of a "fieldless" twin-coil transformer as oscillator-coupler.



amplifier seems to slide in and out of oscillation much more smoothly when bottom-bend rectification is being used, and this is a very desirable feature from the point of view of reception of really distant stations.

Experiments with the Oscillator

One of the most interesting lines of experiments in a Tropadyne circuit is to be found in trying different types of oscillator-coupler, shielding the coupler and so on, and as a preliminary to trying experiments here I made a small modification in the connections which greatly facilitates such work. It will be remembered that the main difficulty in getting the Tropadyne system to work correctly is to find a suitable point for the centre tapping upon the coil, a variation of a turn or so on either side of the best point producing quite wide variations in the behaviour of the set.

Eliminating the Centre Tap

Accordingly, it is a very desirable thing to be able to eliminate the centre tapping altogether, and achieve the desired connection to the electrical centre of the circuit by some other method. The one which I have adopted for use in this receiver employs a scheme of two small condensers in series, so arranged that by a simple adjustment it is possible to find a point at a suitable potential to which the lead from the preceding circuit may be connected.

The revised scheme is shown in the circuit diagram of Fig. 1, where the balancing condenser scheme is indicated by the letters BC. As will be seen, the scheme employed is simply a development of the well-known method of the use of two small variable condensers in series across the grid coil, the connection from the previous circuit being made to the common point between them, a suitable adjustment of the capacities of these two condensers resulting in the point in question becoming a true centre point.

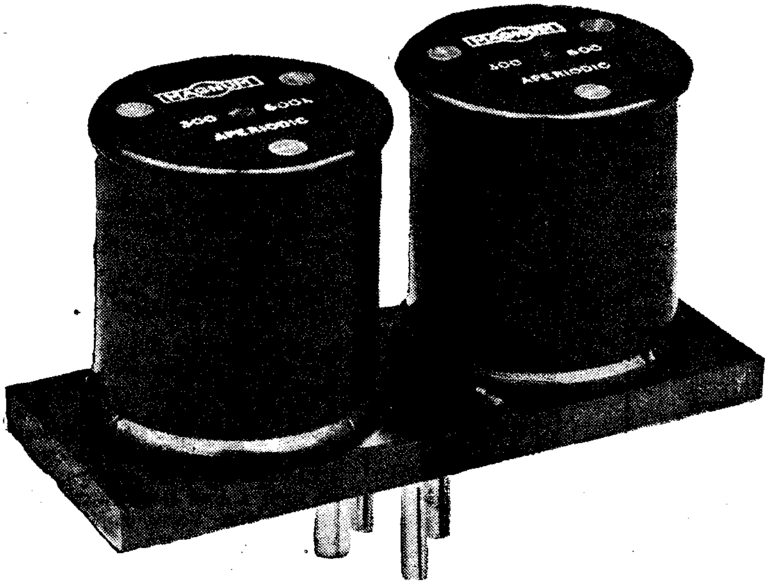
A Combined Condenser

Since the adjustment required always takes the form of a reduction

of one condenser and an increase of the other, it was obviously feasible to combine these two in one component, and this has been done by constructing a small condenser with two sets of fixed plates opposite to each other, and a single set of moving ones which can engage in either of the sets of fixed plates to a greater or less extent. Thus, one can have half the moving plates engaging with one set of fixed plates and the other half with the other set of fixed plates, and thus it is quite easy to balance one against the other until it is found that the moving plates are at the true electrical centre of the system.

The Connections

The particular condenser which I have now incorporated in the set was one made up by Messrs. Peto-Scott for the purpose, consisting of one of their baseboard-mounting neutralising condensers with an extra set of fixed plates, and with a somewhat larger capacity than usual. This I have mounted upon the baseboard beside the oscillator-coupler, and between the latter and the aperiodic transformer. Its connections are as follows: One set of fixed plates is connected to the grid end of the oscillator-coupler coil, and the other set of fixed plates is connected, obviously, to the other end of the coil. From the moving plates a lead goes to the appropriate connection upon the aperiodic transformer, as will be seen from one of the diagrams which is reproduced herewith.



Experiments with two transformers mounted as shown above appeared to indicate that the additional complication involved in this method was hardly worth while.

Easy Testing

A centre tapping is thus no longer needed upon the coil, and it is, therefore, very much easier to try different types of oscillator-coupler, since they need no longer be designed in such a way that a centre point is easy to locate. Instead, any coil can be plugged in, provided that a suitable reaction winding is provided, and then an adjustment of the balancing condenser will enable one to get the set into the correct working condition.

I find that somewhat improved operation results from the use of this modification, since it is easy to obtain exactly the desired adjustment without fiddling with centre tappings, and I should recommend anyone who desires to obtain the very best from his set to make the alteration described, even though he does not intend to use anything except the standard oscillator-coupler. (It will be observed that the particular socket upon the base which was previously used for the centre tapping is now left blank.)

Adjustments

To adjust the set after making this modification, the procedure is as follows: Insert the oscillator-coupler, and set the balancing condenser so that approximately half of the moving plates is engaged with either set of fixed plates. Now set the frame condenser at approximately half its scale reading, and swing the oscillator condenser through its whole scale. You will probably find that clicks are heard at one particular point, indicating that the balancing condenser is not properly set. These clicks should be heard midway between the two points at which the oscillator dial would be set to bring in a station upon the particular wavelength to which the frame is tuned. It will, therefore, sometimes be easier to carry out this adjustment by first picking up a station and testing upon its signals.

Balancing

Next, proceed to vary the position of the moving plates one way or the other, until it is found that the clicks are becoming fainter, and it will presently be discovered that a setting can be chosen with which there are no clicks and the station comes in correctly at its two points upon the oscillator dial. Having found such a point proceed to vary the capacity a little either way, because it will sometimes be found that better results are obtained if slight clicks are still being heard. The click is, in any case, a useful guide to tuning.

Having got the arrangement to function successfully with the original oscillator-coupler, it will be interesting to try various possible designs of coupler, designed for particular purposes. For example, I have been testing the set at a very short distance—namely, about three-quarters of a mile, from 2LO, where, the question of direct pick-up in the various coils has considerable bearing on the selectivity which the receiver will give. In such circumstances it is worth while to experiment with twin or fieldless coils and also with screened coils. So long as no centre tapping has to be found, this is quite an easy business.

A Twin-Coil Coupler

The first test of this nature which I made was to use a ready-made twin-coil H.F. transformer, namely, the Bodine "Twin-eight" transformer, as an oscillator-coupler, the usual grid winding being tuned and the primary winding being used for reaction purposes, for which it proves to be eminently suitable with valves of the fairly freely oscillating type.

A twin-coil coupler of this type certainly seems to give an improvement in selectivity under the severe conditions referred to, and various experimental couplers can be made up on these lines, using, for example, two short pieces of ebonite tube 1½ in. in diameter, mounted upon one of the usual "Special Five"

(Continued on page 77.)

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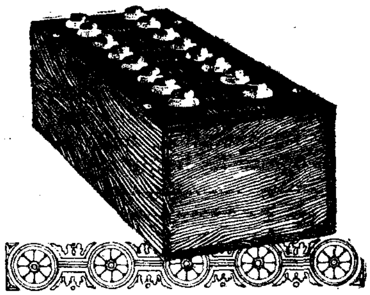

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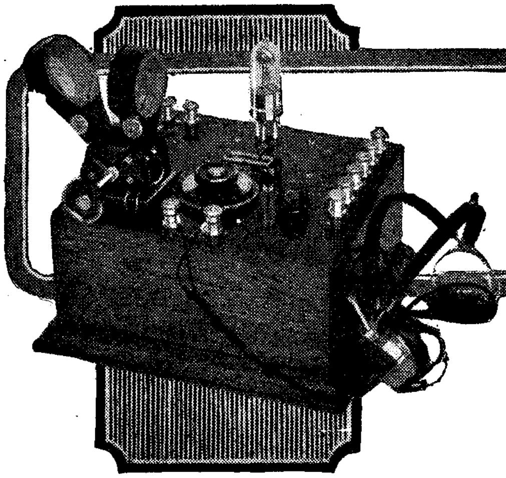

A Chat with Single-Valve Users

by D. J. S. HARTT, B.Sc.

In this interesting article Mr. Hartt gives some very valuable hints on how the "single-valver" may achieve the best results with his set.

THERE are limits to what one can achieve with a single valve, but practically every wireless amateur passes through the stage when, having acquired a valve and the necessary apparatus to connect up a detector circuit, he is always on the look-out for new circuits to try in an endeavour to find the "best" single-valve circuit.

One can naturally understand the great popularity of the single-valve receiver and the desire on the part of their owners to obtain the utmost from their modest equipment, but unfortunately the single-valve regenerative set is, if mishandled, one of the worst offenders as regards the oscillation nuisance. It therefore behoves every user of a single-valve receiver to exercise due caution in its operation, and to learn to recognise its limitations and avoid the indiscriminate use of reaction which only spoils reception both for himself and for others.

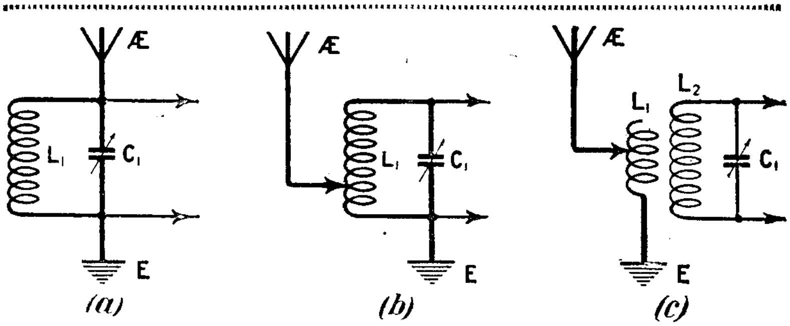

Fig. 1.—By adopting the auto-coupled and "aperiodic" methods shown in (b) and (c) respectively, much can be done to improve selectivity.

Preliminary Considerations

It is proposed in this article to discuss the ways and means whereby the single-valve user can employ his apparatus to the best advantage in order to get the maximum results from his set. In the first place see that your aerial and earth are of reasonable efficiency, for you cannot hope to get good results with a poor collecting system, no matter how good your set may be. In fact, a high, well-insulated aerial, unscreened, and with the down-lead kept well away from walls, trees, etc., and led directly to the lead-in, which should be as short as possible, is essential if satisfactory long-distance reception is to be attempted with a single valve. The earth lead should be kept reasonably short, and a sound earth connection made either to a large buried metal object or to a number of parallel wires, which may be 7/22 aerial wire, buried just below the surface of the ground under the aerial. Do not under-estimate the importance of your aerial and earth system, as a friend of mine did when he at first failed to understand why he could not get as good results on two valves as I could

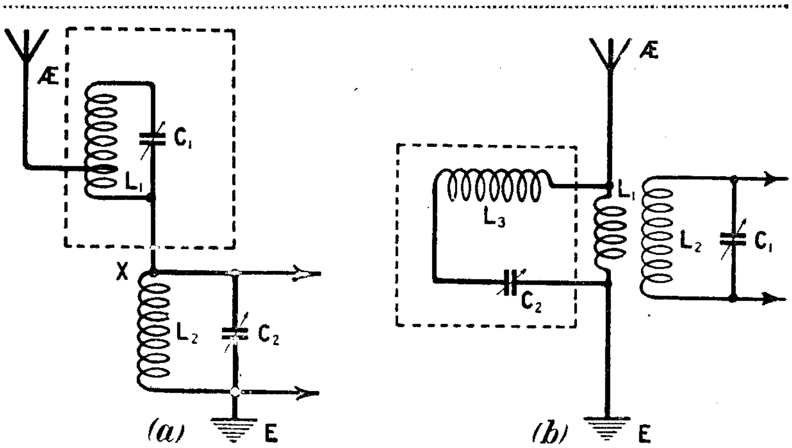

Fig. 2.—Two efficient types of wave trap. That shown at (a) is useful in the case of direct aerial coupling, while the "acceptor" method at (b) is particularly suited to the Fig. 1 (c) form of aerial coupling.

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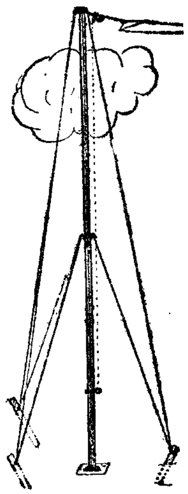

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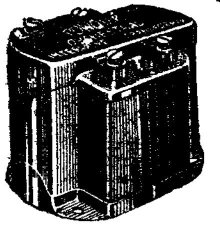

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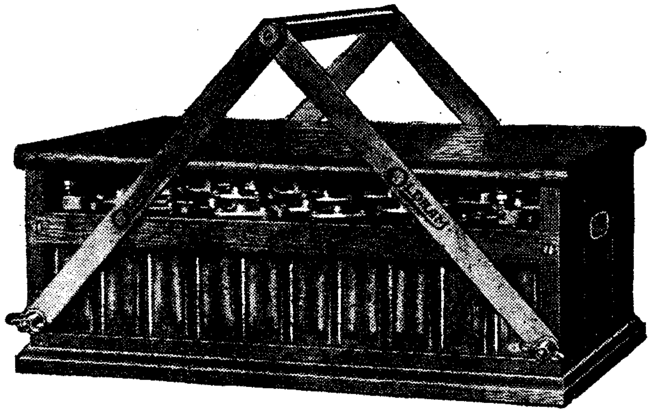

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on one. If those people who seem to spend a large amount of their time swinging a reaction coil to no purpose would first devote a little of their time and energy to improving their aerials and earths, their efforts would probably be better rewarded and others spared a considerable amount of interference.

Choice of a Valve

The next point to be considered is the choice of the valve. Almost any valve will function fairly satisfactorily as a detector when employing grid-leak and condenser rectification, but if you are making a point of purchasing a special valve, some of the special H.F. valves or the resistance-capacity type having a fairly high impedance and large amplification ratio will be found to give excellent results. Valves of this type oscillate freely, and provided suitable reaction arrangements are chosen a very fine and gradual control of reaction is possible. Amongst such valves may be mentioned the D.E.3b and S6 in the 3-volt class, and the D.E.5b, D.F.A.4 and C.T.25b in the 5-6 volt class.

For a single-valve reflex receiver, either a valve of the general purpose type or a valve of the D.E.5 class may be recommended.

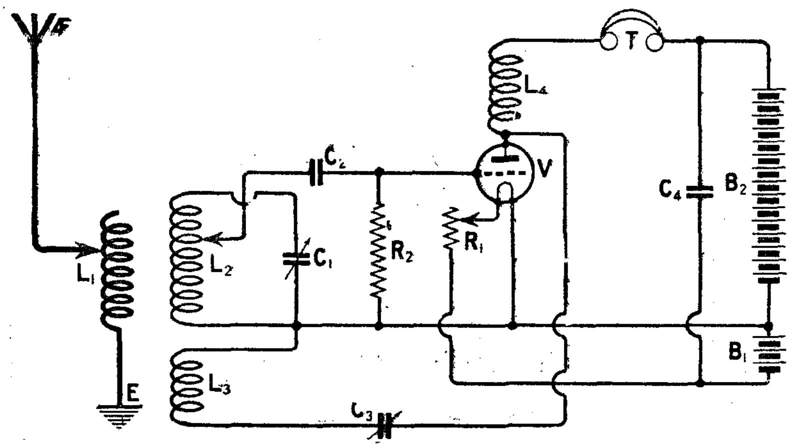
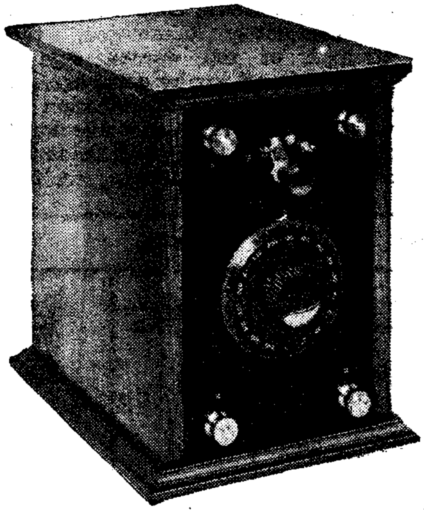


Fig. 3.—By tapping the valve across a portion of the tuned circuit L_2 C_1 the damping effect on this circuit is decreased and selectivity improved.

In this case the valve has to function both as a high-frequency and a low-frequency amplifier, so that one has to adopt a compromise in the choice of the valve, although in most cases a valve of the L.F. class, as represented by the D.E.5, D.F.A.o., etc., will be found to give sensibly better results than a general purpose valve, provided stability is not affected.

Selectivity or Maximum Volume?

As far as the choice of the circuit is concerned, the arrangement you adopt will depend upon whether



A practical example of the Fig 2 (b) wave trap, of which constructional details were given in the October 1925 issue of this journal, is shown above.

you require a selective receiver to enable you to eliminate the local station and receive other stations on nearby wavelengths, whether moderate selectivity and normal volume will satisfy your requirements, or whether you desire maximum volume from your local station.

Improving Selectivity

The rather poor selectivity given by the ordinary direct coupled aerial (Fig. 1 (*a*)) can be greatly improved, without the addition of extra controls, by either of the methods shown in Figs. 1 (*b*) and 1 (*c*). Fig. 1 (*b*) shows an auto-coupled aerial circuit in which the aerial is joined to a tapping on the coil L_1. With this arrangement it will be observed that as the tapping is made nearer the earth end of the coil, so the tuning becomes sharper, thus giving greater selectivity, but at the expense of signal strength. On any given aerial an optimum tapping may be found which gives the best selectivity consistent with little reduction of signal strength over the direct-coupled arrangement. This holds good only for a small band of wavelengths, and to cover the broadcast band satisfactorily several such tappings should be made. Practical trial will soon determine the best tapping to use under any given conditions.

The Tight-Coupled Aerial

Fig. 1 (*c*) shows the "tight-coupled" aerial circuit, consisting of a winding L_1 coupled fairly closely to a closed circuit L_2 C_1, connected across the detector valve, an arrangement which may be very easily adjusted to give a good degree of selectivity. It is desirable either to make the size of the coil L_1 adjustable by means of tappings or interchangeable, so that the degree of selectivity may be adjusted and the optimum size chosen for any given conditions. Mr. G. P. Kendall has shown that this arrangement is not truly aperiodic and a particular size of coil for L_1 cannot be expected to give the best results over the whole of the broadcast band. Usually, however, two coil sizes may be chosen, one suitable for the lower part of the broadcast band and the other for the upper part, such that the whole band may be covered with a reasonable degree of uniformity and fairly good selectivity obtained without a great loss in signal strength compared with the direct-coupled arrangement.

The Size of Aerial Coil

The size of L_1 varies, of course, with different aerials, so that no exact values can be given. However, as a rough indication, 10 to 20 turns for a 3-in. diameter coil are suggested for the higher frequencies of the broadcast band, increasing up to 25 or 30 turns for the lower frequencies. That is, for stations below, say, Newcastle the coil would have from 10 to 20 turns, while the best size for receiving Aberdeen would lie between 20 and 30 turns.

In practice, the coil L_1 should be adjusted to the smallest size consistent with a reasonable signal strength; if it is made still smaller than this, selectivity will greatly improve but there will be a considerable decrease in signal strength. It is important to avoid having too large a size for the coil L_1, for as we approach the condition when the coil is large enough to tune the aerial to the incoming signals both poor selectivity and low signal strength may result.

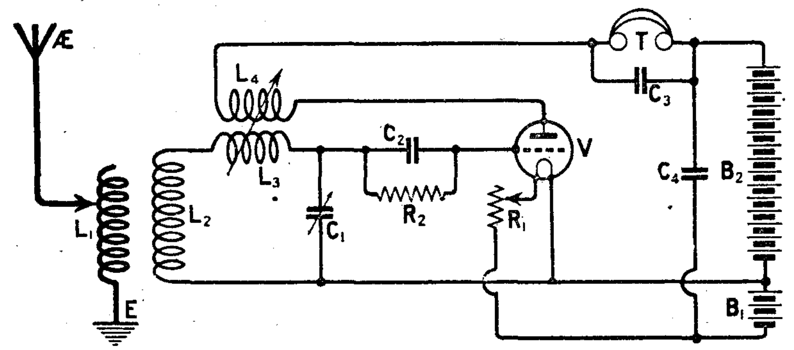


Fig. 4.—The split-secondary method of tuning, although requiring four coils, possesses advantages both from the point of view of selectivity and reaction control.

Wave Traps

In order to attain a high degree of selectivity, it is necessary to increase the number of tuned circuits, but in the case of a single-valve receiver this calls for great care in the design, since there is a certain loss of signal strength at each stage. There is, therefore, a practical limit to the selectivity which can be obtained in this way with a single-valve set, if a reasonable sensitivity is to be maintained.

The single-valve user in search of selectivity is, however, chiefly concerned with the elimination of a powerful local transmission, and if he is able to do this successfully a moderate degree of selectivity will prove satisfactory in searching for more distant stations. It is for this reason that the use of a wave trap has many advantages. Very little extra complication is involved if a suitable type of trap be chosen, for if the design is such that the tuning of the trap and receiver circuits are largely independent, only one preliminary adjustment of the trap is required, and ordinary tuning can then be carried on in the normal way.

Two Useful Types

Figs. 2 (*a*) and 2 (*b*) show two of the best of the more usual types of wave trap. Both of these arrangements possess the advantages that there is little interaction between the wave trap (within dotted lines) and tuning circuits and although a strong local station can be completely eliminated, the strength of the wanted signals is not reduced to any great extent. Fig. 2 (*a*) shows a modification of what is called the "series rejector" type of wave trap, in which the aerial is connected to a tapping on the coil L_1. This coil may conveniently be a 50-turn solenoid on a 3-in. former, and C_1 a ·0005 condenser. The position for the tapping point is best determined by experiment to suit the particular aerial in use; thus a tapping point should be made, say, every ten turns for the first thirty turns, from the end connected to L_2 and the best one chosen from trial. Connecting the aerial in turn to points five turns on either side of this may result in a still better adjustment being obtained. In practice the circuit L_1 C_1 is tuned to the interfering signal, so that the aerial may first be connected to the point marked X and the unwanted transmission tuned in. The trap should then be connected in circuit and the condenser C_1 adjusted so that the unwanted signal is eliminated. Tuning on C_2 is then carried out in the normal way, after perhaps a slight readjustment of C_1. It is important, of course, to see that the coils L_1 and L_2 are placed well apart and in the position of minimum coupling.

A "Series Acceptor" Wave Trap

Fig. 2 (*b*) shows what is called a "series acceptor" wave trap applied to the tight coupled aerial circuit shown in Fig. 1 (*c*). This consists of a coil L_3 placed in series with a variable condenser C_2 and connected across the aerial coil L_1. The circuit L_3 C_2 is tuned to the frequency of the unwanted signals for which it then provides a by-pass across L_1. When this has been done, the circuit L_3 C_2 is left at this adjustment and tuning carried out in the ordinary way on the condenser C_1. For this arrangement L_3 may be a 70- or 80-turn coil on a 3-in. former and C_2 a variable ·0003. The same remarks as to isolating the coil L_3 from the other two coils apply as in the previous case.

Reducing Grid Circuit Damping

It has been shown by Mr. G. P. Kendall that in the case of a detector valve employing grid-leak and condenser rectification, which imposes a fairly heavy damping in the grid circuit, a marked increase in selectivity may be obtained by tapping the valve across only a portion of the grid tuning inductance. Fig. 3 shows a

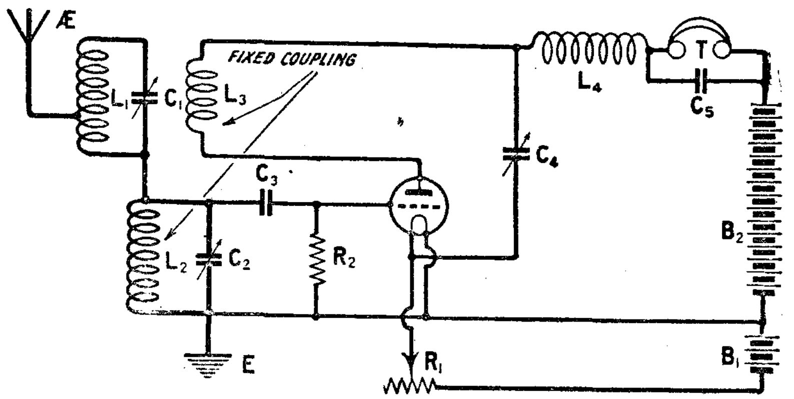


Fig. 5.—In this circuit the reaction effect is obtained by adjusting the value of the variable condenser C_4, the coupling between L_2 and L_3 being fixed.

practical circuit employing this scheme. A tight-coupled aerial is employed and a suitable tapping is taken from the grid coil to one side of the grid condenser. In this circuit a fixed reaction coil L_3 is coupled to the grid coil L_2 and reaction is controlled by the condenser C_3; L_4 represents a high-frequency choke. Experiments have demonstrated that a tapping point about two-thirds along the coil L_2 from the filament end gives a very useful increase in selectivity without much sacrifice in signal strength, so that this scheme is worthy of the attention of the single-valve user.

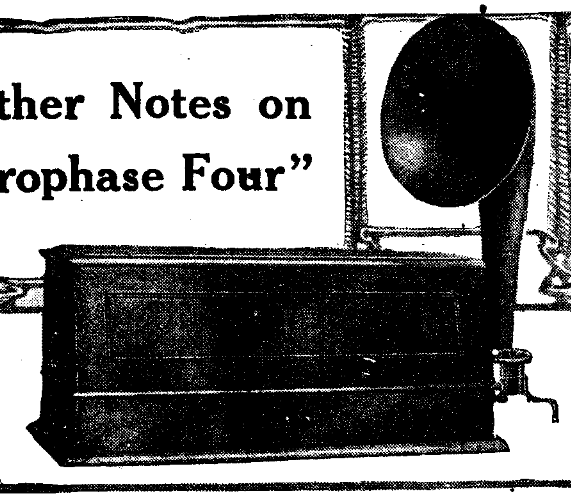
Split Secondary Tuning

An arrangement which gives an improvement both in selectivity and in reaction control is given in Fig. 4, which shows a split-secondary circuit. The secondary coil is divided into two portions, L_2 and L_3; the aerial coil is coupled to one portion and the reaction coil L_4 to the other. Each of the coils L_2 and L_3 may be a No. 35, tuned by a condenser of ·0005, or a No. 50 for L_2 and 35 for L_3. These combinations will be adequate to cover the broadcast band. It is of course understood that the two coils constituting the secondary are not inductively coupled—that is, they should be placed at right angles or in the best position for minimum coupling.

Reaction Control

The foregoing are some of the chief schemes for improving the selectivity of a single-valve receiver, but reaction also plays a very important part in achieving this end. It is, however, important to secure a fine and gradual control of reaction, if the best use is to be made of it, so that the set can be brought gradually up to a point sufficiently near to the state of oscillation to give the desired increase in signal strength and sharpness of tuning without introducing appreciable distortion. This state of affairs may be attained either by the method shown in Fig. 3 or by what has been called the "throttle-control" method, which is embodied in the circuit shown in Fig. 5. In both these arrangements a fixed reaction winding L_3 is used; this should not be coupled too closely to the grid coil and should be kept as small as possible consistent with obtaining adequate reaction over the whole tuning range. In the Fig. 5 circuit, L_4 is a high-frequency choke and the condenser C_4 controls the reaction effect.

Some Further Notes on the "Neutrophase Four"



By J. H. REYNER B.Sc.(Hons), A.C.G.I., D.I.C., A.M.I.E.E.

Further interesting details concerning the "Neutrophase Four" receiver have come to light as the outcome of certain experiments carried out by Mr. Reyner.

SEVERAL points have been raised by various correspondents concerning the "Neutrophase Four" which was published in the March, 1926, issue of MODERN WIRELESS.

Some doubt appears to have been introduced concerning any tendency to parasitic oscillations.

A Tendency to Oscillate

In a previous MODERN WIRELESS article (February, 1926) I dealt with the serious defect of circuits employing centre-tapped coils due to the tendency of half the coil to oscillate at its own natural frequency, which with Dimic coils is in the neighbourhood of 10,000 k.c. (30 metres). Ordinary neutralising arrangements are ineffective as a counter to this mode of oscillation, but the difficulty may be overcome by using an arrangement of a tapped coil and a full coil alternately, as shown in Fig. 1.

Neutralising is then effected on the second valve by connecting the neutralising condenser from the anode of the valve V_2 to the remote end of the preceding tapped coil L_2.

Alterations in Layout

In the "Neutrophase Four," the circuit of which is shown in Fig. 2, this connection was adopted, and it was further found that with such an arrangement the anode coil of the second valve could still be centre-tapped if desired. In the particular receiver described no parasitic oscillations were observed, but I have subsequently found that this mode of oscillation is possible, particularly if the layout is departed from in any way. In such cases two remedies are possible. One is to revert to the connection given in Fig. 1, so that the second anode contains the full coil. The reaction condenser should then be connected between the anode of V_3 and the grid of V_2.

The other alternative is to connect a 100,000 ohm leak across the anode half of L_2 (Fig. 2), *i.e.*, between the anode of V_1 and HT+2. The reaction may be left as originally connected or, if desired, altered as just described, whichever is better.

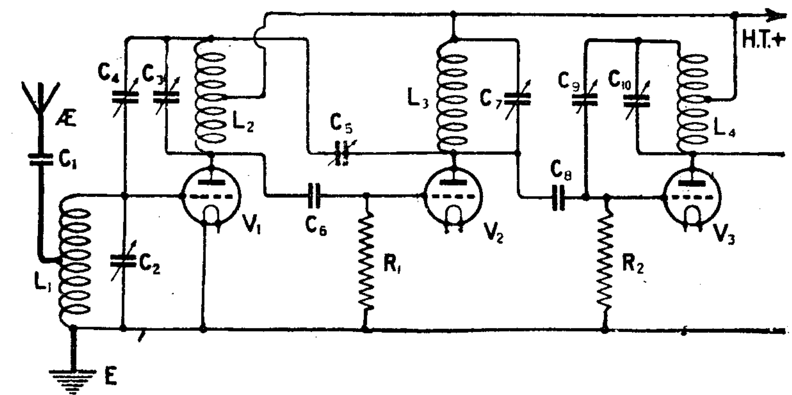


Fig. 1.—Parasitic oscillations with centre-tapped coils are overcome by employing an ordinary coil for L_3.

Difficulties

One or two readers have experienced trouble in neutralising the circuit, which in some cases has proved impossible. In order to find the cause of this I have been making a thorough investigation of the circuit. In most cases the layout given had been departed from in some measure, more particularly as regards the positions of the three coils.

Some Unexpected Results

This led to an investigation of the coupling between the coils, as a result of which some unexpected facts have come to light which are published this month. Suffice it to say that there is appreciable coupling between the first and third coils, and that this becomes *relatively more important* if the distance between the coils is *increased*. The success of the original layout was thus due, in no small measure, to its compactness!

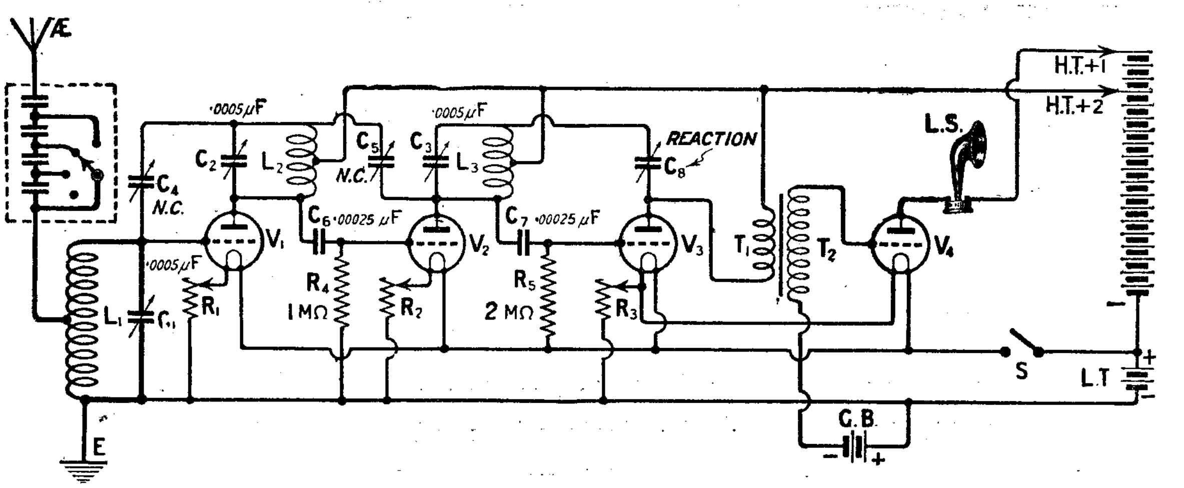


Fig. 2.—The original circuit of the "Neutrophase Four" receiver which appeared in the March, 1926, issue of "Modern Wireless."

An Improvement

The investigations, however, showed that a marked improvement could be effected by connecting the earth to the centre point of the first coil instead of to the end of. the coil. This considerably reduced the capacity coupling between the several coils. The aerial arrangements have to be slightly rearranged as shown in Fig. 3. The aerial circuit appears to be sufficient to check any tendency to parasitic oscillations in the first valve, but if this does not prove to be the case a 100,000 ohm leak between aerial and earth will prove effective.

Without this modification it is possible to obtain conditions where the stray coupling between the coils is greater than that through the valves so that neutralisation is impossible. This comparatively small change, however, renders the circuit stable even if the position of the coils is altered slightly.

A Final Check

As a final check the set should be tuned in to the local station and the centre coil removed. The signals should either vanish or be dead weak, showing that the coupling between the first and third coils has been eliminated.

One final word may be given concerning the neutralising, which applies not only to this circuit but to other similar arrangements. The method of adjusting the circuit given was to tune in the set to the local station and then to turn out each valve in turn and to adjust the appropriate neutralising condenser until signals vanished.

A Slight Adjustment

This gives a rapid approximate adjustment, but it will often be found in practice that the setting so obtained is not quite correct, and a further slight variation will be found necessary to prevent the set from oscillating throughout the whole range. In my instrument a *decrease* of the neutralising condensers by about three-quarters of a turn is required.

If this effect is noticed, therefore, it should not be ascribed to any defect in the set, but is quite in order and is commonly observed with neutralising circuits.

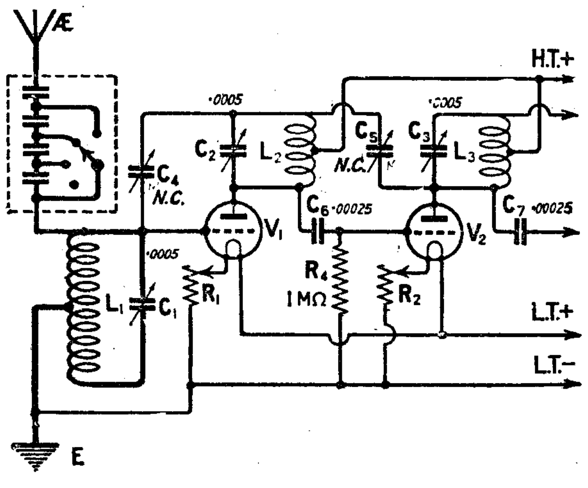


Fig. 3. — Connecting the earth to the centre point of coil L_1 and the aerial to the top end of the same coil gave improved results.

The "DX" Four.

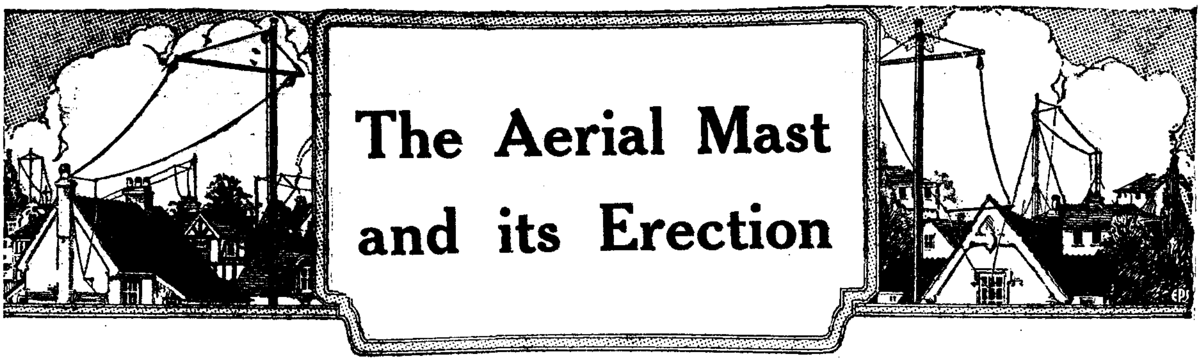
SIR,—In the October, 1925, issue of MODERN WIRELESS Mr. D. J. S. Hartt described the "DX Four."

I built the set according to instructions, and have been using it for six months. I do most heartily congratulate the author upon having designed what I call an ideal set. Its selectivity is of exceptionally high order. I have not the least trouble in separating London from Madrid, Madrid from Manchester, Manchester from Bournemouth, Bournemouth from Hamburg, and Hamburg from Dublin, and all within 10 degrees on my tuning dials. I have not yet used headphones on the set but have tuned in 43 stations direct on to a Sterling Mellovox loud-speaker. The reaction is quite the smoothest that I have ever handled. I am continually being told by friends and others who have listened to my set that it is the most perfect reproduction of speech and music that they have ever heard. Personally I am more than satisfied with it.

Yours truly,

P. O. APPLEBY.

Letchworth.



The Aerial Mast and its Erection

Readers will have no trouble in erecting a cheap and durable mast if they follow the instructions given in this article.

At this time of the year many amateurs consider the possibility of erecting an aerial mast to replace an existing one which has not weathered the winter storms with advantage, and the following description of my own experience may be of use to those who wish to erect a mast which shall be cheap and at the same time durable.

The Choice of Height

Despairing of obtaining a suitable larch pole at a reasonable price, I visited a local wood-yard and selected the longest length of 2 in. by 2 in. (quartering) they had, which was 20 ft. long. When buying, the amateur is advised to see that there are no large knots or cracks, especially at the corners of the wood. I had decided on 30 ft. for the length of the mast, and so an extra 12 ft. length was bought to join to the 20 ft. length —allowing 2 ft. for overlap. I chose a 30 ft. mast because to get really good results with a crystal set I had found this height to be the minimum in my particular circumstances, and also because a greater length than 30 ft. is rather unmanageable.

Preparing the Wood

First of all the wood was planed smooth, the shorter piece being then tapered off to a circular section, leaving 2 ft. at one end for joining to the longer piece, the diameter of the thinner end being made about $1\frac{1}{2}$ in. This taper removes a good deal of the weight and yet does not reduce the strength appreciably. The next thing was to join the two pieces together. To do this three bolts each $\frac{1}{2}$ in. by $4\frac{1}{2}$ in. were used, Fig. 1 indicating the position of the bolts in question. After the nuts have been securely tightened, it is advisable to rivet over the ends of the bolts to prevent possible unscrewing.

At the top of the mast was fixed a pulley, let into the wood and held by a 2 in. by $\frac{3}{8}$ in. bolt and nut (Fig. 2), and over this is screwed a circular disc of wood which serves to keep the halyard on the pulley and also to prevent the wet from soaking into the wood. At this stage the mast was given three coats of paint and tarred for 3 or 4 ft. from the bottom where the wood enters the ground.

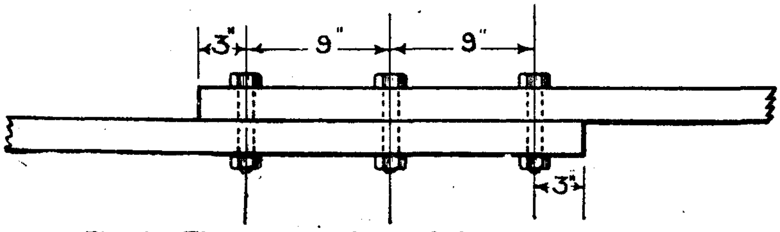


Fig. 1.—The two sections of the mast are joined with three nuts and bolts.

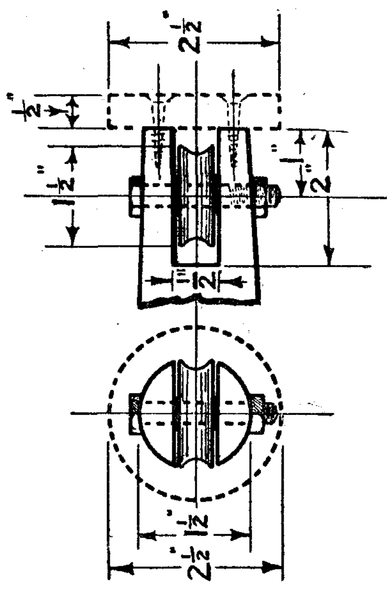


Fig. 2.—Dimensions of the masthead showing how the pulley is fixed.

The Stays

It was decided to fix three stays to the mast, one at the rear attached to the top of the mast to take the pull of the aerial, and one on each side of this at about 120 degrees with it. These two stays were attached to the joint of the two mast lengths, Fig. 3, showing the positions diagrammatically. The stays were attached to large screw-eyes fixed into the mast.

After attaching the three lengths of stay wire to the screw eyes, and passing the halyard (which should be of manilla rope, or, failing that, good "linen line") through the pulley, the mast is ready for erection.

Raising the Mast

Having decided on the site, a hole was made about 3 ft. in diameter and 3 to 4 ft. deep to receive the end of the mast, the positions of the anchors to which the stays are attached being also settled upon. In most gardens suitable walls or trees will be found, but failing this, hard wood pickets about 3 ft. long should be driven into the ground, and eye bolts or screw eyes attached to them (Fig. 4).

Then comes the actual erection of the mast, and here help will be required. Lay the mast on the ground with the lower end over the hole which is to receive it, and get your "confederate" to stand on this end (or otherwise prevent it from rising), while you raise the other end over your head and gradually work towards him. The method is probably familiar to all—it is used by builders to raise ladders.

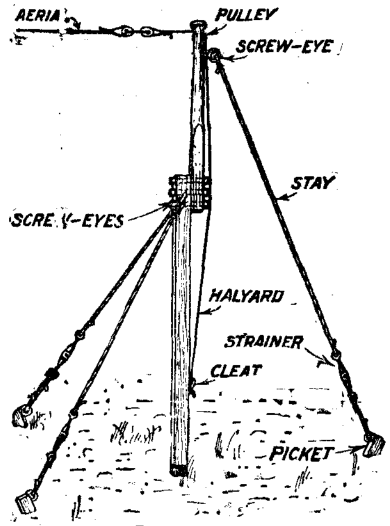


Fig. 3.—The final arrangement will resemble that shown in this diagram.

Final Operations

Having raised the mast to a more or less vertical position, earth is lightly rammed into the hole, and while one person steadies the mast, the other attaches the stays to their anchors. To tighten the stays I used strainers (ex. R.A.F.), and having fixed these stays, the earth is finally rammed tightly round the base of the mast. A cleat should be attached to the mast, to which the end of the halyard can be secured.

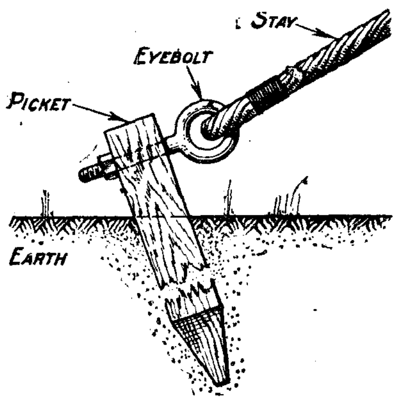


Fig. 4.—Stay wires can be attached to a hard wood picket.

An Important Detail

When hauling up the aerial, do not have it too tight, as when the halyard becomes damp it shrinks, and this may throw a great strain on the aerial if it is already tight.

W. E. M.

More "Modern Wireless" Successes

The "Prince Receiver."

SIR,—I am writing to you to express my appreciation of the "Prince" Receiver, described by Mr. A. S. Clark in the January, 1926, issue of MODERN WIRELESS.

I find the tone of this far superior to any set I have had. At the present moment, in the daylight, Daventry fills the house on a Sterling Primax loud-speaker. 2LO is also full loud-speaker strength at about 40 miles.

I find a D.E.5b valve best for detector with two B.T.H.B6's following. With regard to the D.E. 5b, I run this off a 4-volt accumulator with a dual rheostat just coming on the B.E. side. The H.T. on this valve is only 9 volts and G.B. 3 volts.

As a matter of fact I have incorporated this 3 valver in an 8 valver, 4 H.F., etc., and find that it is every bit as good with the H.F. in front as without. The 3 valver is, however, the family listening set.

I cut my H.F. stages (2 stages at a time) in and out with jacks and plugs, L.F. the same, the filaments all being controlled with the jacks. The H.F. side is primarily the T.A.T. with aperiodic primaries and tuned secondaries (or X coils) and the set is so selective that I can get anything that is not being deliberately jammed. If two stations can be separated I can do it with ease. With best wishes for MODERN WIRELESS and your other publications.—Yours truly,

A. JOHNSON.

Sittingbourne.

The "Special Five."

SIR,—Having seen your requests for results with the "Special Five" receiver, described by Mr. Percy W. Harris in the November, 1925, issue of your journal, I have much pleasure in enclosing particulars of a log made with this set. Valves P.M.4's and B.5, coils 35 and 60 (home-made lattice type), H.F. transformers (home-made as per Mr. Harris's specification).

I find geared condensers an absolute necessity, and am fitting latest "Ormond" 55–1 geared.

A bank of power amplifying valves used in the recent radio telephone tests between London and New York under the auspices of the Radio Corporation of America and the American Telephone and Telegraph Co.

The selectivity of the instrument is truly incredible, and geared condensers are the only way of getting the best out of the set. I have been handling sets for four years, but this beats the lot.

The following is the log, all on a large B.T.H. loud-speaker :—

London, Birmingham, Manchester, Sheffield, Stoke, Leeds - Bradford, Nottingham, Liverpool, Plymouth, Hull, Cardiff, Bournemouth, Dublin, Newcastle, Glasgow, Belfast, Petit Parisien, Toulouse, FPTT, Lyons, Dortmund, Elberfeld, Hamburg, Munster, Stuttgart, Frankfurt, Radio Cadiz, Barcelona, Radio Catalana, Radio-fonica Italiana, Union Radio, Seville, Berne, SBR, Malmo, Oslo, Nuremberg and Copenhagen.

This gives a total of 38, and at least 30 of these can be depended on to give full loud-speaker strength. The others vary. My aerial is fairly good; height, 40 ft.; length, 80 ft.

My age is 16, and I have taken MODERN WIRELESS and the *Wireless Constructor* from the first numbers, and have, of course, constructed many of the splendid sets described therein.—Yours truly,

T. CARLYON.

Wellington, Shropshire.

Good News.

SIR,—My fellow-sufferers "on the banks of the Southern Railway" will doubtless be glad to hear that the overhead system may be replaced shortly by the "third-rail" system on the L.B.S.C. section. This may mean a diminution in the interference from the "artificial atmospherics."—Yours faithfully,

J. R. HUTCHINS.

Norbury.

IN PASSING

(*Continued from page* 11)

to amplify twice at high-frequency it is essential that it should be a valve eminently suitable for this kind of work, preferably one with a very high impedance value. Its next duty is to act as rectifier, and here we have found that to get the best results from the transformers T_1 T_2 and T_5 T_6 a medium impedance is desirable.

When it is working as a low-frequency amplifier it is of the utmost importance that the impedance should be low. Though we have tried every valve on the market, with the exception of one or two which we were unable to borrow from anyone, we have not yet been able to find one which answers all these requirements. Professor Goop is at present engaged in tackling the problem of producing a variable, and he hopes before long that the desired end may be attained by means of his Synchronised Reciprocating Anode which expands and contracts rhythmically in such a way as to produce different impedance values as and when required.

A Simpler Form

Meantime, until the new valve is upon the market, we have found it best to make up the set in a very much simplified form, using five separate valves to perform the various duties. Not a few of those who are jealous of the Professor's great achievements and my own have sneeringly remarked that in this form the set does not justify its name. To them, we would point out that though the set *looks* like a straight five-valver, it is nothing of the sort, since the five valves are only doing the work that will be undertaken by one as soon as a suitable pattern is placed upon the market. Further we would add that in any case the name is justified, since there are *five* valves in *one* cabinet.

The Listener-In.

ADDING REFINEMENTS TO THE OPEN-AIR SUPERHETERODYNE

(*Continued from page* 64)

transformer bases and wound with 50 turns of number 40 gauge single silk-covered wire upon each tube to form the grid winding. 25 turns for each tube will suffice for the reaction winding, it being understood that the appropriate windings are joined up in series so that the currents travel round one tube in one direction and the other in the opposite direction, to produce the desired "fieldless" effect.

Short-Wave Work

The new scheme of connections shown renders it very much easier to modify this super-heterodyne for work upon the shorter waves if desired, by the insertion of an oscillator-coupler of suitable size for the particular waveband which it is desired to cover, and by cutting out the first valve from the circuit. This latter operation is carried out as follows. Remove the first valve and the aperiodic transformer from their sockets, and connect together the grid contacts of each socket by means of a short piece of flex bearing upon each end a valve pin. A suitable sized frame aerial must, of course, be used, and about three turns will be found suitable for such stations as KDKA, a diameter of 2 ft. being used. I hope to deal with these points at greater length at some time in the autumn when short-wave reception conditions are more favourable than they are at the moment.

An Important Point

A point which I should like to emphasise strongly for the benefit of readers who may have made slight modifications in the design, concerns the by-pass condenser across the L.F. transformer primary. I recently tried a different transformer in my set, and found that a value of ·002 was essential (instead of ·0005) to make the set work properly.

If, therefore, you have used a different type or make of transformer and find that the long-wave amplifier is not working very pleasantly and signals are poor, try a large condenser between the anode of the second detector and the filament circuit.

Free Blueprints for "Modern Wireless" Readers

CONDITIONS OF OUR FREE BLUEPRINT SERVICE.

Commencing with this issue of MODERN WIRELESS, one blueprint of any set published in this and future issues will be supplied *free* on application. The coupon to be found in each issue of MODERN WIRELESS must accompany the application, which should be made through the post; callers will not be supplied.

REMEMBER :—

1. Only *one* blueprint will be supplied free to each applicant. (Extra blueprints may be obtained at 1s. 6d. each, post free).

2. Only *postal* applications for blueprints will be considered, and the necessary coupon must be sent.

3. Coupons are available only up to the end of the month for which the issue is dated, and only cover the sets in the issue for that month.

4. When ordering state the serial number of the blueprint required as well as the name of the set.

SPECIAL NOTICE.

Readers are requested to note that the free blueprint service outlined above will *not* apply to the "Elstree Six" described in this issue of MODERN WIRELESS. Blueprints for the "Elstree Six" may be obtained at 1s. 6d. each (post free) in the usual way.

Enlargement of "Wireless"

Important improvements in well-known weekly journal.

THE popularity which *Wireless* has already attained has been further enhanced by the publication of a considerably enlarged and improved edition, provided with an attractive coloured cover and without any further increase in price. This has been made possible by the incorporation of *Wireless Weekly* with *Wireless*, and henceforth the essential features of both journals will appear under one cover week by week.

A Weekly Journal Without Equal

In this way both *Wireless* and *Wireless Weekly* readers will gain very considerable benefit. On the one hand, the *Wireless* reader will get a very much bigger journal than in the past, while the *Wireless Weekly* reader will obtain all the essential features of this latter journal for two-thirds of the price formerly paid. The concentration of the whole efforts of Radio Press on the production of one comprehensive weekly will produce a journal without equal in the literature on the subject. The joint editors of *Wireless* in its new form are Mr. Percy W. Harris, M.I.R.E., the present editor of *Wireless*, and Mr. J. H. Reyner, B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E., previously Technical Editor of *Wireless Weekly*.

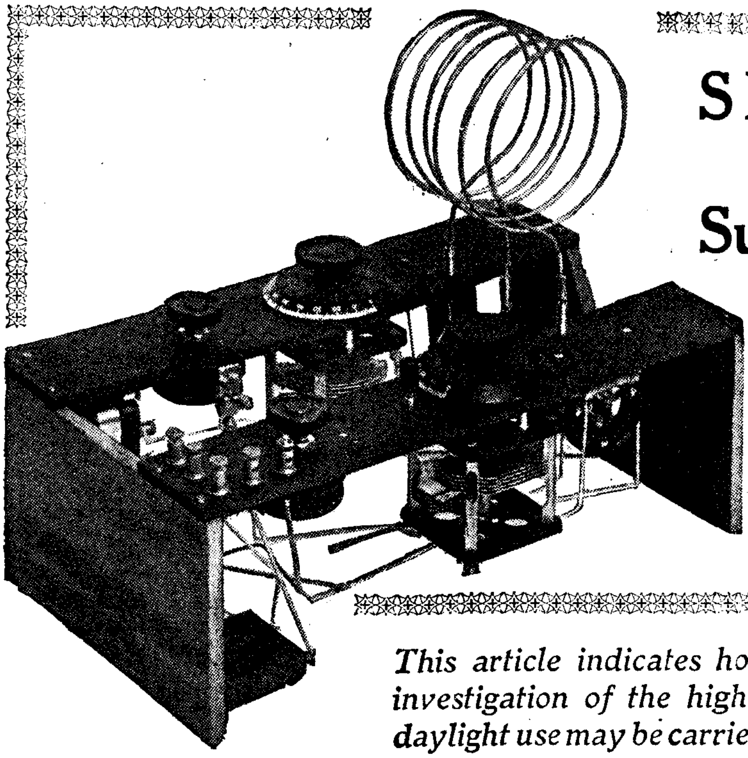
"The Magic Five" Receiver

A special feature of the May 29th issue of the new combined journal is a remarkably efficient and selective receiving set, designed by Mr. J. H. Reyner, B.Sc., entitled "The Magic Five." This instrument represents the fruits of many months of experiment, and the set, which can be very easily built by the home constructor at a remarkably low cost, marks a definite step forward in the development of home-built receivers of high efficiency.

An Important Article

A specially important article will appear in the issue for June 5th, from the pen of Mr. John Scott-Taggart, discussing the developments which the autumn has in store for us. Progress in sets and circuits will certainly be rapid, in sensitivity, quality and selectivity. Mr. Scott-Taggart's article will be found fascinating reading.

Remember to remind your newsagent that you will want a copy of the new *Wireless* reserved for you every week. Issues will be available on the Tuesday of each week. The demand will be very large and unless you place an order for your copy well in advance, you are likely to be disappointed. Look for the new coloured cover.



Short Waves and the Summer Months

By
A. V. D. Hort, B.A.
(5HU)

This article indicates how much interesting and useful investigation of the higher frequencies most suitable to daylight use may be carried out during the summer months.

THE past winter has been marked by a notable series of achievements in successful long-distance communication on short waves, often with surprisingly low power. Perhaps even more remarkable than the outstanding feats of this kind has been the fact that such a large number of amateurs have been able to maintain reasonably constant communication with other parts of the world. Among most amateurs it has now become the rule rather than the exception to be able to get in touch on most nights with stations anywhere within a few hundred miles with only a few watts input to the transmitting valve, while those with slightly higher power have come to reckon their range in thousands of miles.

The Importance of Frequency

It should not be supposed from the above remarks that results of this sort may ordinarily be obtained at any frequency. The frequency in most general use by amateurs at the moment is in the neighbourhood of 6667 Kc. (45 metres), and this frequency has been found to possess certain fairly definite characteristics. In the absence of statistics collected from a number of different sources and spread over a considerable period of time, it is unwise to generalise too much on the peculiarities of any particular frequency. When one is dealing with 6667 Kc., however, it is safe to say that this frequency is useful for short distance transmission during the hours of daylight, while at night much greater ranges will be readily obtainable, the shorter distances being then less reliable.

"Freak Periods"

This, of course, takes no account of "freak" days or nights. These occur from time to time, and any amateur who has carried out transmission or reception on short waves will no doubt be able to remember instances in his own experience. For example, some nights turn out on trial to be completely "dead" so far as wireless is concerned. The writer has in mind at least one night in the last few months when literally not more than a dozen stations were to be heard working, at a time of the night when there are usually dozens audible. Even the various commercial stations, which normally come in at almost deafening strength, sounded weak and "far-away." On other occasions the range of stations was temporarily increased considerably above the normal.

Considering the average days and nights, however, when atmospheric disturbances are not too severe, and when conditions are not freakishly good or bad, the ranges obtainable with 6667 Kc. will usually be found to be as already stated at the different times. An amateur situated in the London district, say, and using moderate or low power, will find that in daylight his signals are reported of good strength by stations within 300 or 400 miles. In reception he will find that stations within this range also come in well, with possibly a certain number at greater distances.

The Effect of Darkness

When both his own station and the distant ones are in darkness, he will find that stations at much greater distances become audible, while at

THE WORLD'S STANDARD **AMPLION** WIRELESS LOUD SPEAKER

Natural Tone

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RADIOLUX
AMPLION
Type R.S.1.O
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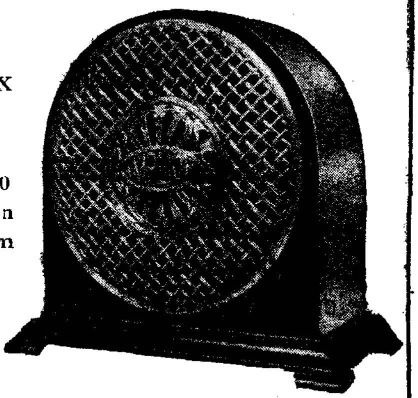

The Radiolux AMPLION has many good points, but perhaps none is more striking than the quality o natural reproduction which it possesses to a remarkable degree.

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There is no substitute for a genuine AMPLION

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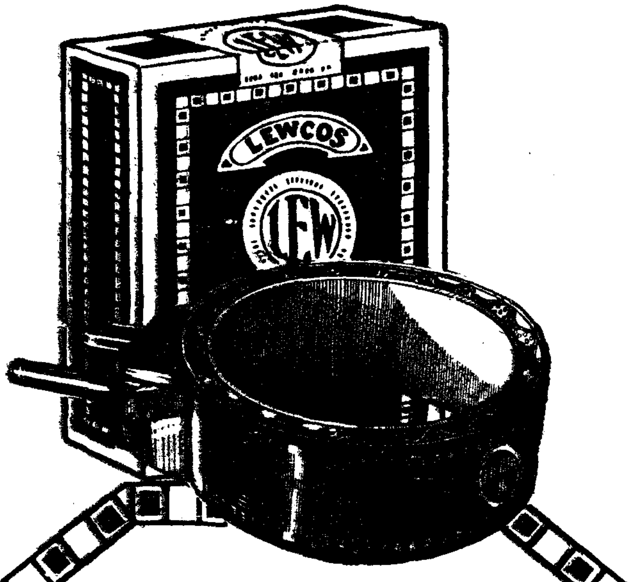


Try the coil that *"makes all the difference"!*

Every listener who has tried the new LEWCOS Coil is talking about the difference it makes. Some say that this coil in the blue box is as different from ordinary coils as "Glazite" is from the old connecting wire. The LEWCOS Coil embodies high electrical efficiency with great mechanical strength. It gives extremely fine tuning and having an exceptionally low high-frequency resistance, increases signal strength. Try the LEWCOS Coil for yourself: it makes *all* the difference!

No.	25	35	40	50	60	75	100	150	200	250	300
Price	4/6	4/6	4/6	5/-	5/6	5/6	6/9	7/6	8/6	9/-	10/-

LEWCOS

Inductance Coil

The LONDON ELECTRIC WIRE COMPANY & SMITHS, LTD.

Manufacturers of Glazite Connecting Wire

Playhouse Yard, Golden Lane, London, E.C.1.

This mark LEW *guarantees quality.*

JUDD.

the same time his own signals may be picked up at greater ranges. It is interesting in this connection to listen on a short-wave receiver round about the hour of sunset. Some station 200 or 300 miles distant may be tuned in, and then the audibility of the signals should be carefully noted from minute to minute. It will often be found that the strength of the signals changes with quite remarkable rapidity, signals which were of good strength becoming almost inaudible within the space of a few minutes. If, on the other hand, weak signals from a more distant station can be picked up while it is still daylight, an equally notable increase in their strength may be recorded as darkness comes on.

It is generally recognised by amateurs who work on the short waves that the best time to start making attempts to work with stations in America,

The operator of Station SMUA, at Göteborg in Sweden, lays claim to be the "oldest inhabitant" of the Swedish ether, being 80 years of age.

for example, is from about 11 p.m. onwards till the small hours of the morning. Attempts to do any work of this kind during the late afternoon are usually no use, American stations being rarely if ever audible on 6667 Kc. in this country at that time.

An Interesting Question

It follows from this that in the summer months, when the hours of daylight are so much extended, the period available for working distant stations on 6667 Kc. is limited. Considerable interest was aroused last year in the question whether it would prove possible to maintain reliable communication with America and other distant parts of the world throughout the summer. Some not inconsiderable success was achieved in this direction, but at that time the 3333 Kc. (90 metres) frequency was in wider use, and the characteristics of that frequency are not the same as those of the 6667 Kc. frequency. With the more general adoption of the higher frequency, and also of higher frequencies still, such as 13044 Kc. (23 metres), about which there is not yet much data on which to base conclusions, it will be a matter of great interest to all who are short-wave enthusiasts to see what the effect of these newer developments will be.

Experiments in America

A series of experiments in America by John Reinartz and others, and also by the Naval Research Laboratories working the station NKF at Washington, have indicated that it may be possible at some future date to select the frequency which shall be most suitable for use over a given range at a certain time of the day or night. Insufficient data have been collected as yet to allow of definite rules being laid down for the guidance of stations, but it has been shown that at a time when signals on one frequency fade out at a certain range, signals of a different frequency get through at good strength. It remains therefore to determine the further details necessary for reliable communication at all times of the day and night, and at all seasons of the year.

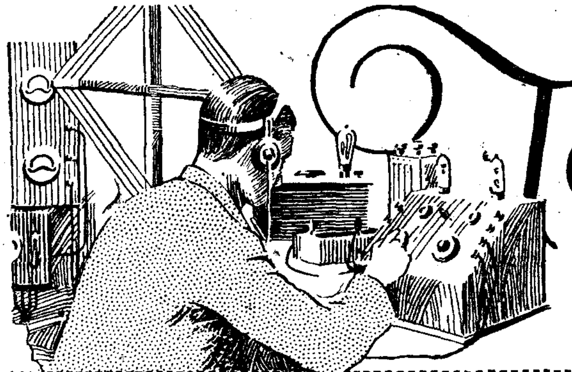
It should be apparent that it does not follow at all that the coming of summer means a cessation of short-wave activities, or at least that it need not do so. Quite apart from the question of light and darkness, the summer has its own problems to be solved and difficulties to be overcome. Perhaps the most obvious of these difficulties is the greater prevalence of atmospheric disturbances during the summer months.

A Valuable Hint

Here again, however, a change of frequency may be found to be of assistance. It is often found that when atmospheric disturbances are quite intolerable at one frequency, they are by no means so violent at another. The present writer has suggested before in these pages that this fact will sometimes provide a solution to the atmospheric difficulty in the reception of broadcasting. The suggestion in this case is to try the effect of receiving the local broadcasting station on a short-wave harmonic, using, of course, a short-wave receiver for the purpose. Then it will frequently be found that the programme can be received with much greater freedom, if not complete immunity, from atmospheric disturbances.

Conflicting Evidence

In the same way it seems likely that it will be possible to discover the most suitable frequencies for use under all sorts of varying conditions. At present the evidence available is conflicting, but in fact no great mass of data has been collected together and analysed, so that the full exploitation of the possibilities of short waves will depend largely on the accumulation of a large number of individual observations under different conditions of locality, time and frequency. A continuous log of, for example, the conditions for reception on every day throughout the year may seem of little value at the time of compilation, but a subsequent analysis of the notes for the whole year may be expected to provide a good deal of useful information, expecially if several observers in different localities can compare their notes.



Tested by Ourselves

Low-loss Plug-in Coil

WE have received from Mr. F. G. Ketelbey one of his Solenex plug-in coils for test and report.

This coil is provided with the conventional plug and socket mounting, this being composed of a black insulating substance. The coil itself is contained in a transparent orange case measuring $3\frac{1}{4}$ ins. in diameter. The winding of the coil is of a special wave form, in order, it is claimed, to reduce its losses and self-capacity.

The coil submitted was a No. 50, and on measurement its inductance was found to be 210 microhenries,

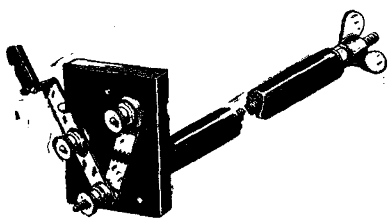
The Solenex plug-in coil is enclosed in a transparent case.

while its high-frequency resistance was quite low. In a secondary or tuned anode circuit with a ·0005 variable condenser in parallel with it, this coil will approximately cover from 195 to 560 metres.

Although somewhat light in its construction it proved on test to be perfectly robust, and able to stand up to a good deal of rough treatment. The plug proved a good fit in several sockets of standard type.

Lead-in Insulator and Earthing Switch

MESSRS. The Igranic Electric Co., Ltd., have sent us one of their combined lead-in tubes and earthing switches for test and report.



The Igranic lead-in tube and earthing switch.

The lead-in tube consists of an ebonite rod 10 ins. long and $\frac{5}{8}$ in. in diameter, through which passes a metal rod. On the outer end of this is a wing nut, underneath which the lead-in to the aerial proper may be connected. At the other end of the rod is a small oblong piece of ebonite which carries three terminals and the lever of the earthing switch. The lever of the switch is hinged under one of the terminals, which is connected direct to the lead-in. Between this and one of the other terminals which is intended to be connected to earth is a small spark-arrester gap consisting of a series of serrations in the edges of two flat strips of metal placed about $\frac{1}{8}$ in. apart.

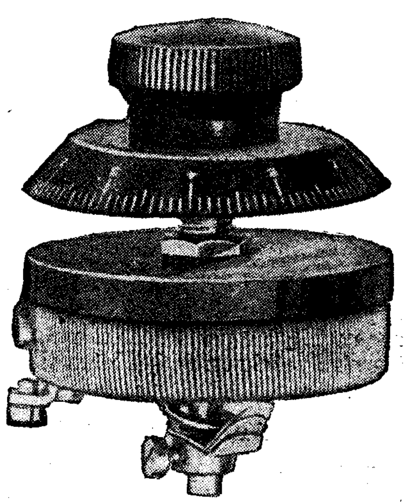
The other terminal, which is intended to be connected to the aerial terminal of the set, can be joined to the aerial by means of the lever which makes contact with a special form of spring contact. When the lever is thrown over to the opposite position, however, the aerial is connected to earth and the set is disconnected. The insulation resistance of this component was found to be infinity, and the switch arm was found to make good contact under both terminals. This component is quite robust and well constructed and can be recommended for use.

Filament Rheostat

WE have received from Messrs. The Penton Engineering Co. a bright emitter filament rheostat for test.

General Details

This component is of good construction and solidly made. One-hole fixing is provided for, while contact to the resistance element is made by means of a three-leaf spring, the tension of which can be adjusted as desired.



A three-leaf spring enables contact to be made to the resistance winding on the Penton Engineering Co.'s filament rheostat.

The resistance element is firmly wound on an insulating strip, which is then bent round a moulded insulating mounting. Connections are made to one end of the winding and the slider by means of small screws passing through metal lugs.

Laboratory Tests

The resistance of the rheostat is 6·6 ohms at its maximum value, and considerably less than ·1 at its

minimum. It is, therefore, entirely suitable for use with bright emitter valves. The action of the moving contact is positive, and a continuous variation of the resistance from its maximum to its minimum value is possible.

General Remarks

The overall diameter of the resistance is less than two inches, and, therefore, does not occupy a large amount of space at the back of the panel.

Where filament resistances of this type are desired this should prove a useful component.

High Resistance Potentiometer

MESSRS. The Igranic Electric Co., Ltd., have sent us one of their high-resistance potentiometers for test and report. The resistance element of this component consists of a heavy deposit of graphite on a circular track, the sliding contact being made through a carbon brush which is carried in a spring holder. The whole of the metal terminals and one-hole mounting bush are carried on an insulated moulding, a removable cover being provided by which the mechanism may be inspected. A special form of indicating dial is provided.

When placed on test it was found that the total resistance of this potentiometer was 50,000 ohms. It was found to be silent in operation and may be mounted on the panel by means of a ¼ in. hole. Connections are made to it by means of terminals or soldering tags, and the whole component is well finished and constructed. This potentiometer can be thoroughly recommended.

Air-Spaced Wire

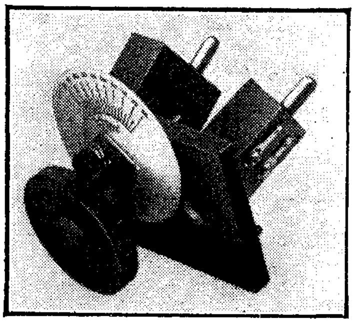
MESSRS. Belling-Lee, Ltd., have submitted to us a sample of their air-spaced wire, which is specially intended for the winding of low-loss coils. The wire is served with two thick threads running in opposite directions which cross each other at intervals of about ⅛ in. It is thus possible to close wind an inductance coil with this wire in the normal manner, while obtaining a fair spacing between the individual turns and the former itself.

Using a length of the 24 gauge wire, a coil was constructed on a 3½ ins. diameter former, 42 turns being wound on, taking up a space of 2⅜ ins. The inductance of this coil was then measured and found to be 180 microhenries, while its high-frequency resistance was nearly 4·5 ohms. This gives an $\frac{R}{L}$ ratio of ·025, which is an extremely good figure, even in view of the low inductance of the coil.

We can thoroughly recommend this wire as a means of enabling low-loss coils of high efficiency to be wound without difficulty.

Coil Holder

WE have received from Messrs. E. J. Lever one of their Trix two-way coil-holders for test and report. This instrument, which is of the one-hole fixing type, uses a geared control for the moving holder, a reduction in the neighbourhood of 4 to 1 being obtained. The moving and fixed holders are placed at an angle so that instead of the coils standing straight out from the panel, they are inclined upwards at an angle of 45 degrees. A white ivorine scale, graduated from 0 to 90 degrees, is provided, while a



A reduction ratio of about 4 to 1 is obtained with this two-way geared coil-holder.

pointer which is geared to the control knob so as to move with the coil-holder indicates the coupling in use.

When placed on test it was found that the insulation resistance between both plugs and sockets was infinity, and a number of well-known makes of plug-in coils proved to be an excellent fit in the holder. Connections may be made either by fixing screws or soldering tags, and the component is well finished and soundly constructed. We can recommend this coil-holder for use.

H.F. Choke

MESSRS. Metrovick Supplies, Ltd., have submitted one of their Cosmos H.F. chokes for test and report.

This component is exceedingly compact, being 2½ ins. long and ⅝ in.

n diameter, and consists of an insulating spool on which the windings of the choke are carried. Two short lengths of bare wire are provided to connect this component in circuit, and when placed on test its D.C. resistance was found to be 330 ohms. When used as an H.F. choke in several circuits their functioning was found to be perfectly satisfactory, and we can recommend this component for use.

Grid Leak

MESSRS. Pye have submitted to us for test and report one of their grid leaks.

The rated value of this leak is 2 megohms, and when placed on test its actual value was found to be 1·9 megohms.

In appearance this leak is of the familiar cartridge type, the resistance element being carried in a small tube of black insulating material. The leak is somewhat shorter than the standard size, but it is provided with two wires to which connection may be made.

This component may be recommended for use, being strongly constructed and constant in value.

Dumetohm Grid Leak

MESSRS. the Dubilier Condenser Co., Ltd., have submitted to us for test and report a number of their Dumetohm grid leaks.

The resistance of these leaks, which are of standard dimensions, is, we understand, of a metallic nature, its value being independent of the applied voltage. The resistance is contained in a small glass tube. The value of each leak is clearly marked, and the rated values of the leaks submitted were ·25, ·5 and 2 megohms each. When placed on test they were found to have exactly the rated value in each case, and when used in conjunction with a detector valve they were satisfactorily silent in operation.

A number of special holders for these leaks were also submitted, each consisting of a pair of spring clips held on an insulating moulded base, terminals or soldering tags being provided for making connection. The insulation resistance of these holders was found to be infinity; while both the finish and the construction of these components are satisfactory.

We can thoroughly recommend these grid leaks for use.

Nickotime Tunometer Coil

MESSRS. The Tunometer Works have sent us several of their Nickotime tunometer coils for test and report. Two of these provide a continuously variable inductance, while two are fixed inductances constructed on similar lines.

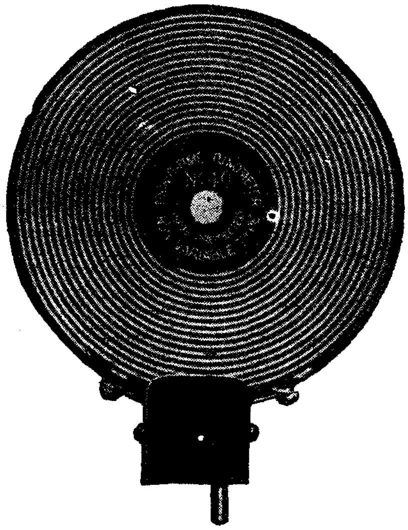
Construction

The construction of these coils is very ingenious, the coil consisting of a spiral winding laid in a groove cut on a flat circular disc of ebonite.

In the case of the aerial and reaction coils, the diameter of this disc is 6 ins., the one side carrying a winding right up to the outer edge. A metal rod which revolves on a spindle in the centre of the disc is arranged to rotate parallel to the surface of the disc, and carries a sliding wheel which has a groove cut in it. This groove engages with the wire which projects slightly above the surface of the disc, and thus by rotating the arm the amount of inductance used can be varied at will. A substantial ebonite knob with a knurled edge is provided for rotating this arm. The other side of the disc carries a small fixed winding, while the plug mounting allows for the provision of a loading coil being placed in series with the winding.

Test Results

When placed on test, both aerial and reaction tuners were found to have a range from a minimum of 110 microhenries to a maximum of 154 microhenries.



The "Nickotime" Tunometer coil is of unusual construction.

When placed on test in the aerial circuit of a receiver, it was found that the aerial tuner required a certain amount of parallel capacity in order to bring in 2LO. Positive fine tuning was possible by means of the moving contact, a variation of about 90 deg. on the contact arm tuning Bournemouth in and out. The contact was found to be noiseless with the set just on the oscillation point. Good signal strength and selectivity were obtained, and distant stations came in slightly above average strength.

It was found rather difficult, however, to couple the aerial and reaction tuners together, and particular care had to be taken against the two contact arms touching, in which case the high tension battery would have been shorted.

The aerial tuner was tried out in an H.F. stage, and here a loading coil was required or else a parallel capacity. With a No. 40 loading coil, it was found possible to tune from just below 2LO to just above 5IT.

High Efficiency

The fixed inductances of 40 and 50 turns were $4\frac{1}{2}$ ins. and 5 ins. in diameter respectively. They were found to have a value somewhat below that usually obtained with plug-in coils of this size, but their high frequency resistance was extremely low, the coils proving extremely efficient in actual use.

All these coils are highly finished and well constructed, while their efficiency is of a high order. They are somewhat bulky, however, while the variable inductances have rather a limited tuning range. They can be recommended, however, as giving excellent signal strength, both on local and distant stations.

Anti = Microphonic Dual Purpose Valve Holder

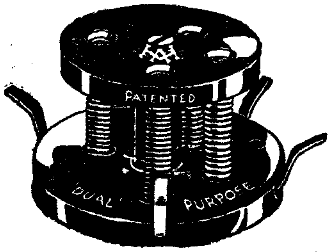
OUR Elstree Laboratories have tested and examined a sample of the anti-microphonic dual purpose valve holder sent to them by Messrs. A. H. Hunt, Ltd., Croydon.

This component consists of two insulated discs, each being spaced approximately ⅝ in. apart, the discs being supported by an ebonite rod. In the smaller disc 4 holes are drilled, and in the larger disc 6 holes are drilled, the extra holes being for use when screwing the valve holder to a baseboard. Four springs are utilised for making contact to the valve pins, and the consequent springy motion renders the valve holder anti-microphonic.

As the name implies, this accessory can be utilised for two purposes. In the first place, it can be used for baseboard mounting, and, secondly, for mounting on the underside of the panel, and when used in the latter case it is necessary to drill four holes in the panel.

When this holder was tested it was found there were no rubbing contacts which usually cause a certain amount of crackling, and it is to be noted that the wire of the springs which make contact with the circuit connections form part of the springs themselves. The holder was tested in a receiving set, and proved a useful type of accessory. It was noticed, however, that in some cases it was difficult to keep the valve upright in position, and it would generally lean towards one side of the holder.

The component has a neat and well-finished appearance, and except for the one disadvantage previously mentioned, it can be recommended to those requiring a dual purpose valve holder.



The anti-microphonic dual purpose valve holder submitted by Messrs. A. H. Hunt, Ltd.

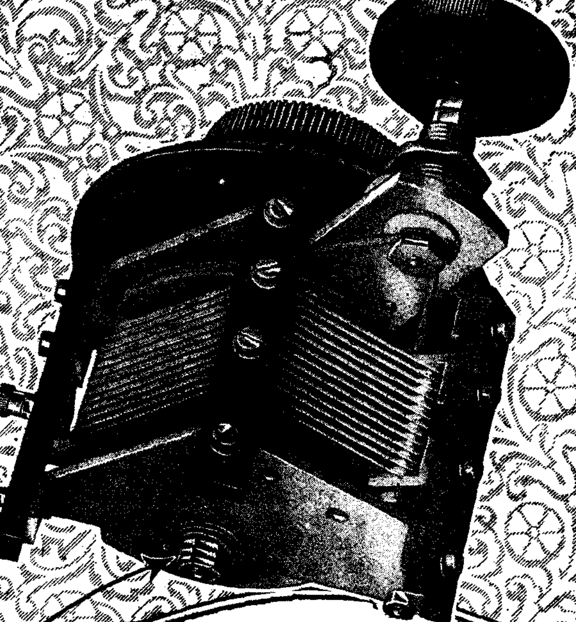
"Wobbly" Base Mounting Valve Holder

AN interesting type of valve holder has been sent to us for examination by Messrs. A. H. Hunt, of Croydon. This holder represents one of the simplest forms possible, combining an anti-microphonic action with a minimum of capacity. Each leg is independently sprung, thus ensuring a minimum of metal parts being employed. So as to ensure a smooth definite contact with the valve leg, a separate small brass sleeve is fitted inside each insulator, enabling the valve to be inserted or withdrawn without damage to the springs.

Four feet are provided so as to raise the brass contact strips from the panel or base board, while one of the sockets is coloured red in order to denote the anode contact to the valve. The valve holder is well made, simple to fit, and can be thoroughly reommended as an efficient and well made component.

Combined Wavetrap and Filter

WE have received from Messrs. Claude Lyons, British agents for the General Radio Co.



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LOW LOSS SQUARE LAW SLOW MOTION

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The Condenser for fine tuning.

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Slow Motion	·00025 mfd.	14/9
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Ordinary	·00025 "	12/-
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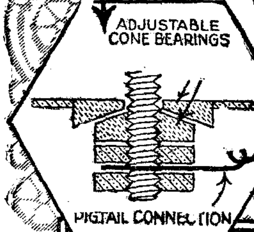

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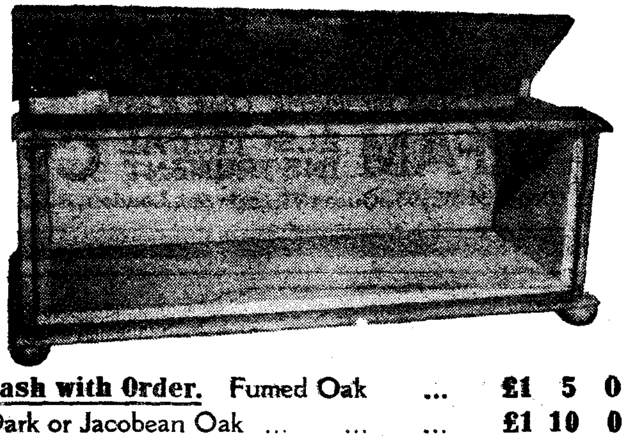

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Detachable 7" deep Base Board to mount 21" by 7" panel to slide out of Cabinet front.

Also supplied at 10/- extra with two beaded front doors placed 2 ins. in front of the enclosed panel.

Ebonite or Radion Panels Supplied and perfectly Fitted at low extra cost.

All Polished with the new enamel that gives a glass hard surface that cannot be soiled or scratched. SENT FREE.—Catalogue of standard Wireless Cabinets in various sizes and woods.

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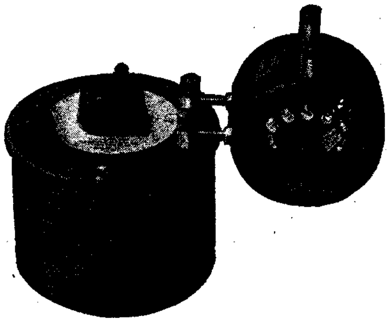
CAXTON WOOD TURNERY CO., Market Harborough

of America, a combined wavetrap and filter.

This instrument comprises a small geared condenser to the terminals of which a special coil is connected. This coil is provided with two windings, one of which is tuned by the condenser and the other of which acts as a coupling winding and is tapped with a small switch. The aerial circuit is connected to the coupling winding, which may either



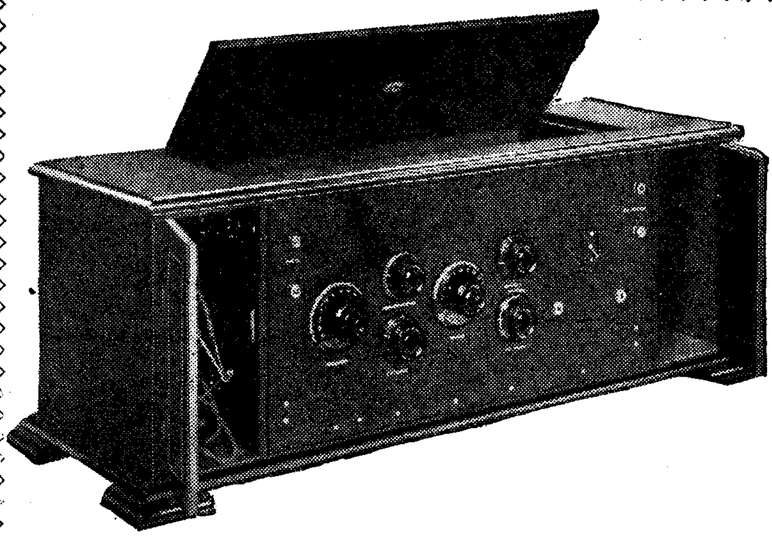
A combined wavetrap and filter received from Messrs. Claude Lyons.

be arranged as a series part coupled rejector, or as an acceptor circuit shunted across the receiver.

The condenser is calibrated in wavelengths when used with the appropriate coil, and on test this calibration was found to be accurate over the whole of the range. When employed as a wavetrap, it was found to assist the selectivity to a considerable extent, although it was not quite as good as the tapped auto-coupled arrangement which is very commonly employed. The instrument is very well constructed and attractively finished. The calibration of the condenser scale renders the device particularly suitable as an absorption wavemeter (one of the purposes for which it is intended), while the trapping action is quite up to standard. We can thoroughly recommend this component for use.

Ebonite Bushes

Ebonite bushes made by Messrs. The Darex Radio Co. have been tested at our Laboratories. They are intended for use in mounting terminals, etc., on wooden panels or baseboards; and are made in various sizes to take standard B.A. shanks. Tests showed that the insulation resistance of these bushes was infinity, and they therefore form a useful and reliable means of mounting.



More Aids to the Home Constructor

Two New Radio Press Envelopes

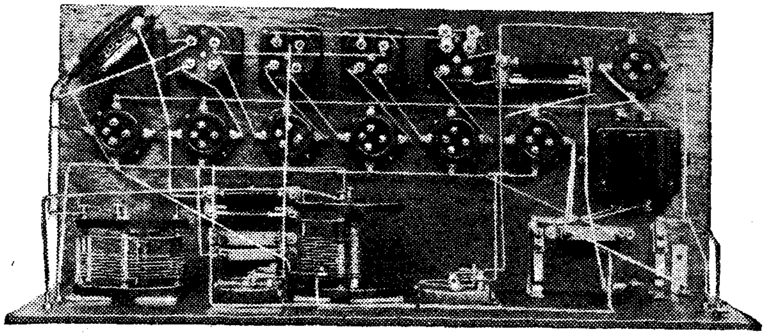
TWO new Radio Press Envelopes of particular interest have just been published and are now available through all the usual sources. The first, Radio Press Envelope No. 12, deals with the "Super Seven"—a simply designed but efficient seven valve supersonic heterodyne receiver—designed by Mr. Percy W. Harris, M.I.R.E., whose designs are so well known to readers of this journal.

Many Interesting Points

There are a large number of interesting points about the receiver, which we venture to think will make it very popular with all home constructors. First of all it is an all-British instrument, all of the parts are readily obtainable, the constructional work has been reduced to a minimum, and the total cost of building the instrument has been carefully kept within a very reasonable figure. As an example of the simplicity of construction, mention should be made of the front panel which carries the condensers and controls. With the exception of the "on" and "off" switch, every component on this panel is of the one hole fixing variety, while at the back of the panel each component screws down on to a wooden baseboard with ordinary wood screws. The layout of the instrument has been the subject of much careful thought, and the extreme simplicity of the wiring will be gathered from the accompanying photograph which views the instrument vertically. The whole instrument is enclosed in a very handsome cabinet, and can if necessary be run entirely from dry cells.

Different Types of Valves Possible

To meet the needs of those who are not prepared to buy a complete set of seven new valves, arrangements have been made so that different types of valves can be used, so that the home constructor can utilise at least some of those he has at present. The instrument possesses the well-known characteristic of a superheterodyne of giving extremely sharp tuning, enabling station after station to be picked up on the loud-speaker without interference.



The wiring of the "Super Seven" is extremely simple, and as can be seen the general layout is of a very straightforward nature. The photograph in the heading shows the completed receiver.

Furthermore, the quality of reproduction is considerably better than that given by many superheterodynes, and the "background" is remarkably quiet. The instrument has been the subject of the most careful test over a number of months, and using a frame aerial of only 2 ft. in diameter, has given 28 stations at full loud-speaker strength in one evening. The total number of stations now received on this instrument is in the neighbourhood of 50 or 60.

The "Rolls Royce of Radio"

The "Super Seven" Envelope is considerably larger than previous Radio Press Envelopes and, realising that many people who desire to build this receiver have no previous knowledge of superheterodynes and their working, the author has included a very lucid description of the principles of superheterodyne receivers as well as full constructional and working details. The set can be confidently recommended to all who desire to build the type of set which has been described by many as the "Rolls Royce of Radio."

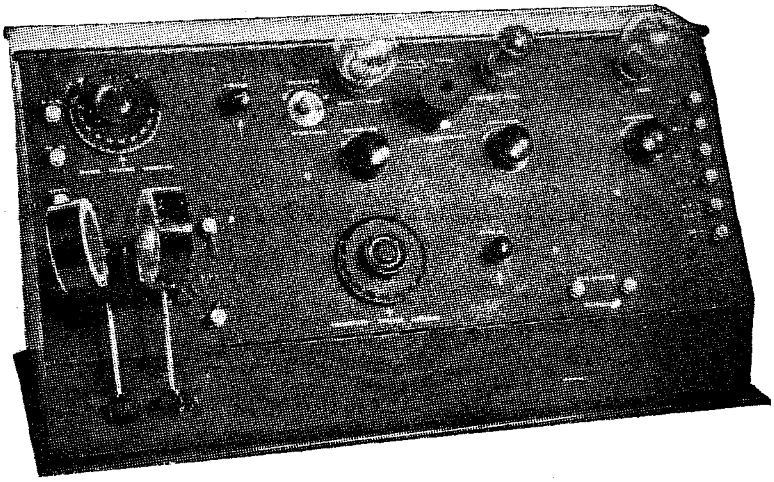
Included in the envelope are full size blue prints of the layout of the wiring and of the panel, and eleven photographs, reproduced on special art paper, give a very clear impression of the finished receiver, and are also of very

great assistance in the constructional work.

The price of Envelope No. 12 is 5s.

The Three-Valve Dual Receiver

The immense popularity gained by the well-known three-valve dual receiver designed by Mr. John Scott-Taggart, F.Inst.P., A.M.I.E.E., has led the publishers of this journal to produce Radio the original model, which contained a somewhat complex arrangement of terminals on the front of the panel for the purpose of changing the circuit to "straight" or "dual" as required. The present instrument is essentially a there-valve receiver, the elimination of provision for circuit changing resulting in considerably greater ease of construction and operation.



The disposition of the components in the "Three-Valve Dual Receiver" is such that its construction should present no difficulties even to the beginner.

Press Envelope No. 13, describing "How to make the Simplified Three-Valve Dual Receiver."

Wireless receivers employing the dual, or reflex, principle seem to present a strange fascination for the average wireless man. This, of course, is not unnatural when it is remembered that in sets of this type one valve is made to do the work normally accomplished by two. Although this is the one and only advantage obtained by using a dual circuit, it will be agreed that the saving of the extra valve, and the consequent economy in current for filament heating, constitute a very important advantage where it is desired to keep running costs as low as possible.

A Simplified Design

The receiver shown in the photographs employs three valves, the first working in the dual capacity of high and low frequency amplifier, the second as a detector, and the last as a plain low-frequency amplifier. Many readers will remember the description of a Three-Valve Dual Receiver in the issue of MODERN WIRELESS for April, 1924, and it was the great popularity attained by this set which led to the production of the present instrument, which is built on somewhat similar lines.

Modifications have been made, however, with a view to simplifying the original model, which contained a somewhat complex arrangement of terminals on the front of the panel for the purpose of changing the circuit to "straight" or "dual" as required.

The fullest possible details of the receiver are given, and the constructional work has been simplified to a high degree.

Loud-speaker reception is possible from the B.B.C. stations and from many of the Continental stations. Every possible detail is given in this envelope, together with several blue prints and photographs. The price of this Envelope No. 13 is 2s. 6d., or 2s. 9d., post free.

Why Use a Separate Oscillator?

(Continued from page 16.)

attractions to warrant serious consideration. On the other hand, when the aim is to produce a superheterodyne which will give good results with the very least trouble and manipulation, even at the cost of an extra valve, the choice is more likely to rest upon one of the separate oscillator types. I hope that these considerations, in which I have endeavoured to prevent my own personal inclinations from causing me to load the dice too heavily in favour of one of these schemes, will enable my readers to see that a decision of the question we have been discussing is one which depends, to a large extent, upon individual requirements.

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JUNE, 1926.

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